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U Plant Aggregate Area Management Study Technical Baseline Report

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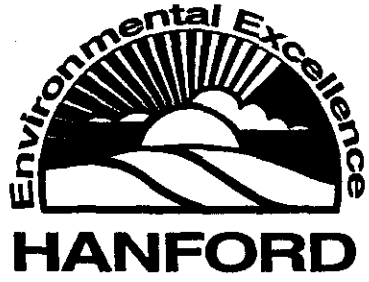

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Richland, Washington

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ACRONYMS

BHI	Bechtel Hanford, Inc.
BP	bismuth phosphate
CASS	Computer Automated Surveillance System
DOE	U.S. Department of Energy
ECN	Engineering Change Notice
GM	Geiger-Mueller
HEDL	Hanford Engineering and Development Laboratory
HNO_3	nitric acid
HWSA	Hazardous Waste Storage Area
MSL	mean sea level
NEPA	*National Environmental Policy Act*
PFP	Plutonium Finishing Plant
PNL	Pacific Northwest Laboratory
PRF	Plutonium Reclamation Facilities
PVC	polyvinyl chloride
RADTU	Radioactive Acid Digestion Test Unit
Redox	reduction and oxidation
RL	U.S. Department of Energy, Richland Operations Office
SWP	special work permit
TBP	tributyl phosphate
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRU	transuranic
UNH	uranyl nitrate hexahydrate
UO_3	uranium oxide
UPR	unplanned release
VCP	vitrified clay pipe
WHC	Westinghouse Hanford Company
WIDS	waste information data system

1.0 INTRODUCTION

This document was prepared in support of an Aggregate Area Management Study of U Plant, 200 West Area, at the U.S. Department of Energy's (DOE) Hanford Site near Richland, Washington. It provides a technical baseline of the aggregate area and results from an environmental investigation that was undertaken by the Technical Baseline Section of the Environmental Engineering Group, Westinghouse Hanford Company (WHC), which is currently the Waste Site and Facility Research Office, Natural Resources, Bechtel Hanford, Inc. (BHI). It is based upon review and evaluation of numerous Hanford Site current and historical reports, drawings and photographs, supplemented with site inspections and employee interviews. No intrusive field investigations or sampling were conducted.

This document was written in 1991 and has been edited for publication as a BHI document to allow the information to be referenced in current documents. Some information identified as current, as of 1991, may not be current as of 1995 because of changes in mission, scope, plan, or political climate.

Most of the historical documents from which data was extracted for this report provide dimensions in nonmetric units of measure. In the interest of accuracy, data is reported here as it was provided in reference documents and no conversions to metric are provided.

The U Aggregate Area is made up of three operable units (200-UP-1, 200-UP-2, and 200-UP-3) and consists of liquid waste disposal sites in the vicinity of, and related to, U Plant operations.

U Plant refers to the 221-U Process Canyon Building, a chemical separation facility constructed during World War II. It also includes the Uranium Oxide (UO_3) Plant constructed at the same time as 221-U as an adjunct to the original plutonium separation process but which, like 221-U, was converted for other missions. Waste sites are associated primarily with U Plant's 1952 through 1958 Uranium Metal Recovery Program mission and the UO_3 Plant's ongoing UO_3 mission. Waste sites include cribs, reverse wells, french drains, septic tanks and drain fields, trenches, catch tanks, settling tanks, diversion boxes, a waste vault, and the lines and encasements that connect them. It also includes the U Pond and its feed ditches and an underground tank farm designed for high-level liquid wastes.

Each waste site in the aggregate area is described separately in this document. Close relationships between waste units, such as overflow from one to another, are also discussed.

Photographs are provided in Appendix A. Unplanned releases are described in BHI (1994). Impacts of unplanned releases upon waste sites are noted in the waste site descriptions that follow.

An environmental summary for this aggregate area is not provided here. An excellent summary may be found in the *Hanford Site National Environmental Policy Act (NEPA) Characterization* (Cushing 1990), that describes geology and soils, meteorology, hydrology, land use, population, and air quality.

2.0 LIQUID WASTE HANDLING

Chemical and radiological wastes from the various Hanford production facilities have been segregated according to potential radionuclide contamination and stored or disposed of accordingly. High-level wastes are stored in underground tanks while intermediate-level wastes were, until 1973, routed to underground cribs for disposal. Low-level wastes such as cooling water were routed to ponds and open ditches for disposal (Smith 1990).

This report will describe waste sites that received all levels of waste.

3.0 221-U PROCESS CANYON BUILDING

The 221-U Process Canyon Building, or U Plant, is a central feature and key operational facility of Operable Unit 200-UP-2 and is therefore described here even though it will not be remediated as part of the operable units in this aggregate area.

The U Plant was one of three identical Hanford chemical separation plants constructed in 1944 through 1945 by the Du Pont Company for the U.S. Army Corps of Engineers in support of World War II plutonium production. Called canyon buildings because of their monolithic size and the canyon-like appearance of their interiors, B, T, and U Plants were built to extract plutonium from fuel rods irradiated in the Hanford production reactors. Each separations plant was equipped to utilize a bismuth phosphate separation process. Early operational experience, however, indicated that B and T Plants were sufficient to meet production goals and U Plant was held in reserve.

U Plant was used to train B and T Plant operators until 1952 when it was converted to the tributyl phosphate (TBP) process to recover uranium from bismuth phosphate process wastes, at that time it became known as the Uranium Recovery Plant.

The U Plant TBP process recovered residual uranium from B and T Plant waste that had been stored in tank farms in the 200 East and 200 West Areas. The waste tanks were sluiced with their own supernatant to produce a slurry that was then pumped to the U Plant via underground stainless steel transfer lines. A counter-current extraction column used organic solutions of TBP in kerosene to preferentially attract uranium, separating it from other fission products and small amounts of plutonium. Uranium was stripped back into the aqueous phase in a second column. The resulting uranyl nitrate was converted to UO_3 by calcination at high temperatures in the UO_3 Plant (Crusselle and Romano 1982; Bramson 1987; Ballinger and Hall 1989; BHI 1994).

GE (1951) describes the function of the plant as follows:

> "The function of the Uranium Recovery Plant is to produce a relatively pure trioxide powder from the uranium irradiated in the Hanford piles and process, for plutonium recovery, through one of the Bismuth Phosphate Plants or the Redox Plant."
>
> "The uranium from the Bismuth Phosphate Plants is stored in underground tanks in the form of a uranium-bearing waste, consisting of sludge and supernatant liquor which contain a large fraction of the radioactive fission products and traces of the plutonium formed in the pile-irradiation of the uranium. Facilities for removal of this uranium waste from underground storage tanks constitute one of the three major components of the plant."
>
> "The second major component...is the TBP Plant, in which the uranium in the waste removed from underground storage is decontaminated from the fission products and residual plutonium by a solvent-extraction process."

> "The third major component...is the UO_3 Plant, in which uranyl nitrate solutions produced by the TBP and Redox Plants, meeting the required purity and radioactivity specifications, are converted to uranium trioxide (UO_3) powder by calcination."

The same underground transfer lines were used to pump U Plant TBP intermediate-level liquid waste to cribs and trenches located near B Plant in the 200 East Area, some three miles distant. U Plant non-TBP waste was disposed of in nearby cribs, trenches, reverse wells, and the U-Pond. High-level waste was transferred to the 241-U Tank Farm. Table 3-1 describes the U Plant liquid waste transfer history (Bramson 1987).

Table 3-1. U Plant Waste History. (2 sheets)

Dates	Source of Waste	Waste Site
11/52 to 12/57	Evaporator Process Condensate from 221-U and 224-U	216-B-12 Crib
11/54 to 11/54	TBP Waste from 221-U	216-B-43 Crib
11/54 to 03/55	TBP Waste from 221-U	216-B-44 Crib
01/55 to 02/55	TBP Waste from 221-U	216-B-42 Crib
04/55 to 06/55	TBP Waste from 221-U	216-B-45 Crib
09/55 to 12/55	TBP Waste from 221-U	216-B-46 Crib
09/55 to 09/55	TBP Waste from 221-U	216-B-47 Crib
11/55 to 07/57	TBP Waste from 221-U	216-B-48 Crib
11/55 to 12/55	TBP Waste from 221-U	216-B-49 Crib
01/56 to 01/56	TBP Waste from 221-U	216-B-17 Crib
01/56 to 02/56	TBP Waste from 221-U	216-B-14 Crib
03/56 to 04/56	TBP Waste from 221-U	216-B-18 Crib
04/56 to 12/57	TBP Waste from 221-U	216-B-15 Crib
04/56 to 08/56	TBP Waste from 221-U	216-B-16 Crib
08/56 to 09/56	TBP Waste from 221-U	216-B-20 Crib
09/56 to 10/56	TBP Waste from 221-U	216-B-21 Crib
10/56 to 10/56	TBP Waste from 221-U	216-B-22 Crib
10/56 to 10/56	TBP Waste from 221-U	216-B-23 Crib
10/56 to 11/56	TBP Waste from 221-U	216-B-24 Crib
11/56 to 12/56	TBP Waste from 221-U	216-B-25 Crib
12/56 to 02/57	TBP Waste from 221-U	216-B-26 Crib

Table 3-1. U Plant Waste History. (2 sheets)

Dates	Source of Waste	Waste Site
02/57 to 10/57	TBP Waste from 221-U	216-B-19 Crib
02/57 to 04/57	TBP Waste from 221-U	216-B-27 Crib
04/57 to 06/57	TBP Waste from 221-U	216-B-28 Crib
06/57 to 07/57	TBP Waste from 221-U	216-B-29 Crib
07/57 to 07/57	TBP Waste from 221-U	216-B-30 Crib
07/57 to 08/57	TBP Waste from 221-U	216-B-31 Crib
08/57 to 09/57	TBP Waste from 221-U	216-B-32 Crib
09/57 to 10/57	TBP Waste from 221-U	216-B-33 Crib
10/57 to 10/57	TBP Waste from 221-U	216-B-34 Crib
12/57 to 01/58	TBP Waste from 221-U	216-B-52 Crib
11/51 to 06/67	Liquid Waste from 221-U, 224-U, and 276-U	216-U-1 Crib
03/52 to 05/67	Liquid Waste from 221-U, 224-U, and 276-U	216-U-2 Crib
05/54 to 08/55	241-U Condensate	216-U-3 Crib
03/47 to 08/55	222-U Lab Waste	216-U-4 Reverse Well
07/55 to 07/70	222-U Lab Waste	216-U-4A Dry Well
01/60 to 09/68	222-U Lab Waste	216-U-4B Dry Well
03/52 to 03/52	221-U Uranium Waste	216-U-5 Trench
03/52 to 03/52	221-U Uranium Waste	216-U-6 Trench
03/52 to 06/57	221-U Counting Box Floor Drainage	216-U-7 French Drain
06/52 to 03/60	221-U and 224-U Process Condensate	216-U-8 Crib
04/60 to 01/88	291-U and 224-U Waste	216-U-12 Crib
07/44 to Present	Waste from 284-W, 2723-W, and 221-U Chemical Sewer, 224-U and 241-U	216-U-14 Ditch
05/57 to 05/57	276-U Waste from 288-U Tank	216-U-15 Trench
01/84 to 1987	224-U Cooling Water and Condensate	216-U-16 Crib

U Plant was placed in standby in 1958 and was subsequently retired. All TBP process hardware remains in place. The canyon building is currently used for storage of spare equipment that has been reconditioned in the T Plant equipment decontamination facility. Decontamination and reclamation activity was also accomplished at 221-U for an unspecified period of time. The overhead crane is

operable. Electrical power, sanitary and raw water, and steam are available. The deck level of the canyon has been decontaminated to a level that allows reasonable access with a low level of radiation exposure. The electrical gallery is contaminated in spots. One building air supply fan and one exhaust fan continue to operate. The exhaust fan exhausts through the 291-U sand filter (Harmon 1975; Baker et al. 1988).

Numerous drawings describe U Plant and its environs. Hanford drawing W-70064 describes the building and references numerous others that provide additional detail. Plant operating equipment layout is described in Hanford drawing H-2-43452, Sheets 1 and 2. The location and arrangement of U Plant waste sites are best illustrated on Hanford drawings H-2-44511, Sheets 44, 52, 59 through 62, 67 through 70, and 75 through 77. These, in turn, reference numerous detailed drawings that further describe the waste facilities shown.

Drawing users should be aware of the Engineering Change Notices (ECN) System that describe changes to be made to drawings. It is necessary that a user check the ECN Release Station Data Base to discover if an ECN exists that impacts a drawing of interest.

Appendix A provides photographs of U Plant.

UN-200-W-46, UN-200-W-48, UN-200-W-86, UN-200-W-101, UN-200-W-117, UN-200-W-118, and UN-200-W-138 describe unplanned releases of radioactive contaminants at or near the 221-U Canyon Building.

4.0 271-U BUILDING

The 271-U Support Services Building is adjacent to the 221-U Canyon Building and shares its northern wall. It is a three story structure made of reinforced concrete and pumice block used to house office space, craft shops, storage and training facilities, all in support of 221-U. It is 160 ft by 48 ft by 65 ft high and is currently unused and empty. Minimal contamination exists in various parts of the building, mostly from contaminated pigeon feces.

This site is not a waste unit, is not listed in the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) and is mentioned here only because it is within the geographical limits of the operable unit and is mentioned in the waste information data system (WIDS) data base (BHI 1994).

5.0 291-U STACK, FAN AND FILTER BUILDING

Like the 271-U Building mentioned above, these units are not waste units, are not listed in the Tri-Party Agreement and are mentioned here only because they are within the geographical limits of the operable unit and are mentioned in the WIDS data base (BHI 1994). These units will continue in active use until the canyon building is decommissioned.

The 291-U-1 Stack is a 200-ft high concrete stack located south of the 221-U Canyon Building and provides stack ventilation for it. It is lined with acid-resistant brick and rests on an octagonal brick and concrete foundation. It is 14 ft in diameter at its base.

Canyon Building air is filtered through sand filters located in the 291-U Filter Building before being exhausted up the 291-U Stack. The filter building is 96 ft by 96 ft by 22 ft high and is partially below grade. Exhausted air enters the filter building through its floor and is directed upward through sand beds held in wooden trays. Two exhaust fans move the air through the filters and up the stack (BHI 1994).

6.0 URANIUM OXIDE PLANT

Like the 221-U Canyon Building, the UO_3 Plant will not be remediated as part of the operable units of this aggregate area, but is briefly described here as a source of wastes flowing to multiple aggregate area waste sites.

The UO_3 Plant is an active production facility that is currently in standby mode awaiting its next production campaign scheduled for Fall 1991. It was constructed in 1944 for fuel processing as part of the original U Plant Complex, but was never used for its original purpose. It was operated as a training facility from 1944 to 1950 and converted in 1952 to a uranium reduction facility. It was converted again in 1955 to its current UO_3 configuration in support of its PUREX UO_3 mission. This mission involves conversion of PUREX generated liquid uranyl nitrate hexahydrate (UNH) to powdered UO_3. UNH is transferred to the UO_3 Plant by tanker truck.

Located immediately south of the 221-U Canyon Building, the UO_3 Plant is a complex of several buildings, tank farm, storage areas, and load/unload facilities. Its primary building is 224-U, a three-story structure measuring 200 ft by 66 ft, providing over 32,000 ft^2 of total area. Hanford drawing H-2-40774 and GE (1951) describe the facility. Hanford drawing H-2-44511, Sheet 68, shows its relationship to other nearby structures and its waste lines to 200-UP-2 waste units.

The UO_3 Plant has provided liquid waste to the 200-UP-2 underground waste units since its beginning as an operational production facility. It contributed to 216-U-1, 216-U-2, 216-U-8, 216-U-12, 216-U-16, and 216-U-17 Crib waste inventories. Currently, noncorrosive steam condensate goes through the 207-U Basins to the 216-U-14 Ditch and other condensate and cooling water to the 216-U-17 Crib (Bramson 1987; DOE 1991; AEC-GE 1964; Millward 1991).

UN-200-W-55 describes a major contamination event that occurred in April 1960 when 1.5 tons of uranium powder was spilled onto the 224-U loading ramp. Additional contaminations of the UO_3 Plant are described in UN-200-W-33, UN-200-W-39, and UN-200-W-78.

Table 3-1 describes the history of liquid waste disposed of to the several aggregate area waste sites.

7.0 PLUTONIUM FINISHING PLANT

The Plutonium Finishing Plant (PFP) (Z Plant), generated low-level liquid wastes that were disposed of through the 216-Z Ditches to the 216-U-10 Pond, both part of this aggregate area. Z Plant is a complex of chemical processing facilities designed to process Hanford generated plutonium to its final product form. Uranium bearing fuel rods were irradiated in one of the several Hanford production reactors; a process that creates plutonium from uranium. The irradiated fuel rods were processed through one of Hanford's chemical separation facilities where the plutonium was extracted and transferred as plutonium nitrate to Z Plant.

Z Plant then processed the plutonium nitrate to its final form on one of three process lines: RG-RB from 1949 to 1953, the RMA Line from 1953 to 1979, and the RMC Line from 1960 to 1973. Each of these process lines created waste streams that contained small quantities of plutonium. The RECUPLEX and Plutonium Reclamation Facilities (PRF) were established to recover plutonium from these waste streams.

Z Plant generated wastes that were both chemically and radiologically contaminated but their disposition was accomplished in accordance with their radiological content. The organic solvent bearing wastes were classified as intermediate-level wastes and, until 1973, were disposed of to the several cribs that supported Z Plant operations. Low-level wastes were primarily disposed of through the Z Ditches into the U Pond.

The balance of this document will describe the many waste sites associated with the U Aggregate Area. For convenience, the descriptions are presented in operable unit order.

8.0 OPERABLE UNIT 200-UP-1

Operable Unit 200-UP-1 includes ten waste sites and seven unplanned releases (UPR). These include low-level liquid waste sites west of the U Plant and south of the Z Plant, including the U Pond and its feed ditches, septic tanks, a French drain associated with the 241-S Tank Farm, and a tank and crib associated with the 401-SX Condenser. The latter three facilities are not associated with U Plant but are included in the operable unit as a convenience because of their location.

8.1 216-U-10 POND

The 216-U-10 Pond was constructed in 1944 to receive low-level liquid effluent from plutonium processing facilities. It received 165 X 10^9 L of contaminated liquid. The Pond was active from July 1944 to 1985. Located southwest of the 221-U Building and south of 16th Street, in the southwest corner of the 200 West Area, the site is at Hanford coordinates N36500 W77500 (center). It has been deactivated, backfilled, and stabilized (BHI 1994; Hanford drawings H-2-02430; H-2-05962; H-2-32527; H-2-36824; H-2-44510, Sheet 9; H-2-44511, Sheet 55).

The Pond covered 30 acres including UN-216-W-14, UN-216-W-15, UN-216-W-16, and UN-216-W-17. It has 190 m^3 of contaminated soil.

Last (1983) describes U Pond and its source ditches as follows:

> "The U Pond disposal system was constructed in 1943 to receive large volumes of relatively uncontaminated waste water from 200 West Area facilities. It originally consisted of two drainage ditches, the 216-U-14 and 216-Z-1 Ditches, that diverted waste waters to a slight natural depression. An overflow ditch was also constructed to carry excess waste water out to a larger depression just outside 200 West Area."
>
> "Over the last 40 years, the U Pond system has undergone numerous physical modifications. These have included the addition, removal, and modification of the various physical components of the disposal system. The majority of the modifications can be directly correlated with changes in discharge sources and volumes released to the U Pond system. The discharge sources include the Plutonium Processing and Reclamation Facilities (231-Z and 234-5Z), laundry and mask cleaning facilities (2724-W and 2723-W), uranium recovery facilities (221-U and 224-U), a powerhouse and water treatment plant (284-W), and, most recently, an evaporator-crystallizer plant (242-S)."
>
> "The large volumes of low level waste water and occasional isolated releases of considerably higher level, non-routine discharges have resulted in the accumulation of transuranic, fission product and activation product inventories. A total of 1.3 X 10^{11} liters of liquid have been discharged to the system through 1982, with a radionuclide inventory estimated to include 8.2 kg plutonium, 1.5 X 10^3 kg uranium, 15.3 Ci ^{137}Cs, and 22.6 Ci ^{90}Sr. The large number of discharge sources, their operational service dates, and the operational service dates of the U Pond system components complicate any attempt to derive total inventories for the individual U Pond components."

Last (1983) continues to report that of the 8.2 kg of plutonium released to the U Pond system, "all but negligible amounts" were released to the 216-Z-1, 216-Z-11, and 216-Z-19 Ditches.

> "Waste water from plutonium processing activities have been continually discharged to the ditches, but the plutonium releases, usually at low levels, have occurred intermittently (Emery and Klopfer 1974). A comparison of the annual plutonium discharges and the service dates of the Z Ditches indicates that the 216-Z-1 Ditch received 138.5 grams, the 216-Z-11 Ditch received 8,074.7 grams, and the 216-Z-19 Ditch received 143 grams." (Last 1983)

> "The site received the following effluents at various times: 284-W Powerhouse process cooling water; steam condensate from 231-Z and 234-5 buildings via 216-Z-1 Ditch; waste water from 2723-W mask cleaning station and 2724-W laundry via 216-U-14 Ditch; chemical sewer wastes from 221-U Building; cooling water from 224-U Building, 231-Z laboratory wastes via 216-Z-1 Ditch; 241-U-110 Tank condenser water via 216-U-14 waste and PNL operations waste from 231-Z via 216-U-14 Ditch; and 242-S Evaporator steam condensate via 216-U-14 Ditch. From 4/80 to 9/81, the site received the same as above minus wastes from 231-Z, condensate. From 9/81 to 7/84, the site received the same as above minus 221-U, 224-U, and 271-U [NR]. After 7/84, the site only received 242-S cooling water." (BHI 1994)

Because the source terms and chemical forms of actinides entering and in the U-Pond cannot be clearly defined, a material balance for plutonium and americum between levels found in the pond and those entering and leaving the pond cannot be developed.

About 1,400 kg of ^{238}U have been discharged into waste trenches leading to the U-Pond. These high levels of uranium, along with potential quantities of other unknown isotopes, become a matter of concern when attempting to interpret the ecological behavior of plutonium and americum in this ecosystem because of the potential toxicity of these elements.

Although weapons grade plutonium processing operations should have discharged wastes containing ratios of ^{238}Pu to $^{239/240}Pu$ are significantly higher in the pond biota then in the pond sediments. These results primarily indicate that transuranics (TRU) are being made "available" and/or utilized by pond organisms in ratios that are not reflected by pond sediment concentrations.

A common source of "available" plutonium and americum for pond biota is suggested by the rapid establishment of ^{238}Pu to $^{239/240}$ Pu. In particular, ratios of ^{241}Am to ^{238}Pu in plant material were different from those of sediments, invertebrates, and goldfish in that they fell either below or above the means and medians for the other four categories of the pond's ecosystem.

Sampling of U-pond sediments done frequently in the same location shows a substantial range in ^{238}Pu and $^{239/240}Pu$ concentrations. This may be because of a wide range in plutonium particle sizes existing in the U-Pond sediments.

Considering the rapid exchange rate of water in the U-Pond (40 hours) and other foregoing conclusions, it is possible that the source of plutonium and americum that is "available" to the pond biota is not the U-Pond sediments, but the sediments of the Z-19 Trench (Emery and Garland 1974).

Last (1983) notes that:

> "The U Pond system has been the subject of numerous published and unpublished studies. Bruns (1975) published results of an aerial radiological survey of the entire U Pond system. From this survey, aerial distribution of total gamma, ^{137}Cs, and ^{241}Am activities were determined."
>
> "The most complete environmental study of U Pond to date was published in two phases by Emery and Klopfer (1974) and Emery and Garland (1974). The first phase documented the physical and chemical characteristics of U Pond and the distribution of plutonium and americum in the pond bottom sediments. The second phase documented the radiochemical factors of the transuranic elements in the U Pond ecosystem and detailed source terms and actinide ratios discharged to the pond."
>
> "Fitzner and Rickard (1975) investigated the use of all Hanford waste ponds by waterfowl and other avian species. Cadwell et al. (1979), Cushing and Watson (1974), and Fix and Blumer (1977) investigated the radionuclide concentrations of the American coot and its role in exporting radionuclides from Hanford ponds."
>
> "A comparative study of the Hanford waste ponds and streams was conducted by Emery and McShane (1978) to determine whether radiological conditions affect the occurrence, diversity, and productivity of biological organisms."
>
> "Gano (1979) investigated the small mammal populations inhabiting the environs of U Pond. Wheeler and Law (1980) reported the results of air, water, mud, and vegetation samples from the U Pond system taken for routine environmental monitoring purposes."

Operating Procedure GO-026-006 covers the deactivation and interim stabilization of the 216-U-10 Pond. It is the only source of information of the U-Ponds stabilization that can be found.

Recent environmental surveys reveal surface contamination of 5,000 to 10,000 dpm on the southwest side of the pond area and animal burrows are evident (Johnson and Huckfeldt 1989).

Aliases for this site are 231 Swamp and U Swamp.

8.2 216-U-11 TRENCH

The 216-U-11 Trench was active from 1944 to 1957 to receive overflow from the 216-U-10 Pond. In its original form, it was 1,880 ft long with a 5 ft wide bottom. A new trench was 3,440 ft long and included 810 ft of the original trench. The trench was U-shaped and sometimes formed a pond when adequate water was introduced. It is described by Hanford drawings H-2-02430; H-2-36824; H-2-44511, Sheet 56; H-6-471, Sheet 19; and photograph A-8 (Appendix A) (Emery and Garland 1974, Stenner et al. 1988).

Until August 1955, the old unit received the overflow from the 216-U-10 Pond. The old unit was retired in August 1955 and portions were backfilled. The U Pond overflow was relocated to a new 216-U-11 Trench at a higher elevation. The new unit received the U Pond overflow until it was retired in 1957. The site contains less than 0.1 Ci beta activity (Stenner et al. 1988, Lundgren 1970).

The site surface has been stabilized with grass. Surface contamination has been noted in periodic surveys. A Pacific Northwest Laboratory (PNL) Hazardous Ranking System Migration Score of 37.75 has been assigned (Johnson and Huckfeldt 1989, Stenner et al 1988).

Aliases for this site are U Swamp Extension Ditch, 216-U-12, 216-U-11 Ditch, 216-U-11 old ditch, and 216-U-11 new ditch (Maxfield 1979).

8.3 216-U-13 TRENCH

The 216-U-13 Trench was used from 1952 until 1956 for equipment decontamination. Located immediately west of the 241-U Tank Farm, 216-U-13 consists two sites, each 200 ft long, 25 ft deep, and 18 ft wide at the bottom. Both ends of the trenches were sloped so that the vehicles could be driven down to the decontamination station at the bottom. The site received drainage from the equipment decontamination processes within the trenches.

Drawings locate the pits at Hanford coordinates (1) N37980 W76020, N38180 W76020 and (2) N37980 W76070, N38180 W76070 (Maxfield 1979; Hanford drawings H-2-44510, Sheet 9; H-2-44511, Sheet 70, H-2-74442; photograph A-4, Appendix A).

The site was deactivated by backfilling the trenches. Decontamination operations were transferred to the 269-W Decontamination Pit. Contaminated soils were removed from the bottom of the pit and taken to the 200 West Burial Ground (BHI 1994).

Ground Elevation is 664 ft above mean sea level (MSL). The water table is 195 ft below grade.

A comprehensive radiation survey was made in 1981 of the ground and surface vegetation in the zoned area of the trenches that disclosed readings of less than background except for two spots (BHI 1994). The area has since been released as a radiation zone and no markers or barriers exist.

There are 640 m^3 of contaminated soil and 11,000 m^3 of overburden soil at this site. This site has a PNL Hazardous Ranking System Migration Score of .10 (BHI 1994).

Aliases for this site are 241-UR Steam Cleaning Pit (BHI 1994).

8.4 216-Z-1D DITCH

The 216-Z-1D Ditch operated from December 1944 until March 1959 as a liquid waste disposal site in support of the PFP (Z Plant).

It received approximately 1M L of process cooling water, steam condensate, and vacuum pump sealant waters from the 231-Z, 234-5Z, and 291-Z Buildings. It is classified as a TRU-Contaminated Soil Site and has a Hazardous Ranking System Migration Score of 45.3 (BHI 1994).

Located in Hanford's 200-UP-1 Operable Unit, the Z-1 Ditch ran from a point immediately east of the 231-Z Building to the 216-U-10 Pond into which it drained. It was a long, shallow ditch; 4,250 ft long, 2 ft deep, and 4 ft wide at its bottom with side slopes of 2.5:1 and a .05% grade.

Deactivated and backfilled in stages, its upper 1,725 ft were backfilled and replaced with a pipeline in July 1949 as part of the 234-5Z Building construction project. The next 2,005 ft were backfilled in 1959 after a plutonium and americum contamination release from the 231-Z Building. The balance of its length was incorporated into the 216-Z-11 Ditch. The first 120 ft downstream from the 231-Z outfall is in common with the 216-Z-11 and Z-19 Ditches (BHI 1994; Lundgren 1970; Baldridge 1959; Hanford drawings M-2904-W; H-2-44511, Series).

The 1959 americum and plutonium contamination was stabilized by backfilling with clean soil. This contaminated area was mistakenly excavated during the digging of the 216-Z-19 Ditch in 1971 (216-Z-19; UPR-200W-110; BHI 1994).

The site is 669 ft above MSL and about 180 ft above groundwater. Its contamination burden includes 1.370 E+002 Ci ^{239}Pu and 3.700 E+001 Ci ^{240}Pu. For purposes of WIDS record keeping, its chemical inventory is included in that of the 216-U-10 Pond (BHI 1994).

Aliases for the 216-Z-1D Ditch include 216-Z-1, 216-Z-11, Drain Ditch to U Swamp, and Z Plant Ditch. It should not be confused with the 216-Z-1 Crib. Deactivation and stabilization of the 216-Z-1D Ditch, and others, is described as follows:

> "216-Z-1, 216-Z-11, and 216-Z-19 (Z-Ditch Complex)"
>
> "Deactivation and stabilization of the Z-Ditch Complex north of 16th Street was brought about by the construction of the new 216-Z-20 Crib. Preliminary work on the active Z-19 Ditch was initiated in August 1981. At this time, the live woody vegetation growing in and along the ditch was treated with a herbicide mixture of glyphosate (Roundup) and dicamba (Banvel). This application, intended to provide an in-place kill of the trees and shrubs, appeared quite effective just prior to backfilling the ditch. An existing groundwater monitoring well located between the buried Z-1 and Z-11 Ditches was extended and retained for future use. Shallow dry wells installed near the Z-Ditch Complex for past characterization studies were either removed or grouted closed in place (well casings west of the ditches were removed while those to the east were grouted closed). All salvageable equipment remaining in the sampling station at the 234-5 Building outfall to the ditch was removed prior to backfilling. The concrete headwall and vegetation were incorporated into the ditch bottom and approximately 400 ft of the ditch was backfilled prior to effluent diversion to the Z-20 Crib. In addition, approximately 1,000 ft of the posted zone to the east (the previously buried Z-1 and Z-11 Ditches) was covered with 6 to 8 in. of clean soil and backfill stockpiled along the eastern side of the Z-19 Ditch. Once Z-Plant effluents were diverted to the new crib, backfilling over the Z-19 Ditch was resumed. As the water level at the headend of the ditch receded, the concrete headwall of the 231-Z outfall and metal at the 231-Z outfall and metal shed at the 234-5 outfall were incorporated into the ditch bottom and the upper portion of the ditch backfilled. The only problem encountered during backfilling occurred while attempting to cover the last open section of the ditch approximately 200 ft south of the ditch head end. Standing water and a large amount of organic material has been entrapped by

backfilling from both ends of the ditch. This area was left alone for about two and one-half days until it appeared that all the water had infiltrated into the ditch bottom. However, as soon as backfill was pushed into this area, it was discovered that the organic material was still quite fluid and rose over the top of the clean fill. At completion, some of this organic material was very near the surface of the backfilled ditch. A survey of the area by Radiation Monitoring resulted in detectable alpha contamination even though the moisture content of the contaminated material remained quite high. The following day a trench was dug parallel to the contaminated area and the material deposited in the bottom of the excavation. Upon completion of the initial cover, a single application of time released herbicide and rodent deterrent was sprayed over the Z-19 Ditch only (approximately 1 acre). Final backfilling operations on the Z-Ditch Complex were completed in October. At this time, the Z-19 Ditch had received between 2 and 3 ft of clean soil, while the depth of cover over the eastern edge of the posted zone (Z-1 and Z-11) tapered to 1 ft. Stabilization of the Z-ditch Complex was completed in October 1981. The Z Ditch Complex has been reposted to "Underground Radioactive Material." (WHC 1981)

8.5 216-Z-11 DITCH

The 216-Z-11 Ditch operated from March 1959 until May 1971 as a liquid waste disposal site in support of Z Plant operations. It served as a replacement ditch for 216-Z-1D.

The ditch received process cooling water and steam condensate from the 234-5Z Building, cooling and seal water from the 291-Z Building, and lab wastes from the 231-Z Building. Total volumes are not reported.

It is reported as a TRU-Contaminated Soil Site and has a Hazardous Ranking System Migration Score of 45.3 (BHI 1994).

The ditch ran from a point immediately east of the 216-Z1A Tile Field to the 216-U-10 Pond into which it drained. It was a long, shallow ditch; 2,615 ft long, 2 ft deep, and 4 ft wide at its bottom with side slopes of 2.5:1 and a .05% grade. It is located in Hanford's 200-UP-1 Operable Unit.

Its southernmost 665 ft was part of the deactivated 216-Z-1 Ditch. The first 120 ft, starting at N39420 W75991, is in common with the 216-Z-1 and 216-Z-19 Ditches. For a short time in 1971, 216-Z-19 flowed through a 900-ft section of this unit, that includes the 665-ft section mentioned above (Baldridge 1959; Lundgren 1970; BHI 1994; Hanford drawings M-2904-W; H-2-44511, Series).

The site is 651 ft above MSL and 180 ft above groundwater. Its contamination burden includes 1.37 0E+002 Ci ^{239}Pu and 3.700 E+001 Ci ^{240}Pu. Its chemical inventory is reported as part of the 216-U-10 Pond inventory (BHI 1994).

The site was backfilled to grade with clean soil when it was retired. Environmental samples taken from its bottom in February 1971 were generally 10 nCi/g. Aliases for 216-Z-11 Ditch include the Z Plant Ditch and the 216-Z-1 Ditch (BHI 1994).

Deactivation and stabilization of the 216-Z-11 Ditch, and others, is described in 216-Z-1D Ditch, above.

The waste site is depicted in Hanford photograph 122440-171CN.

8.6 216-Z-19 DITCH

The 216-Z-19 Ditch operated from May 1971 until September 1981, replacing the 216-Z-11 Ditch as a liquid waste disposal site for various PFP (Z Plant) facilities. It has since been deactivated and backfilled.

The ditch received process cooling waste and steam condensate from the 234-5Z Building, vacuum pump seal water from the 291-Z Building, and cooling water from the 231-Z Building. Total volumes are not reported (Maxfield 1979).

This site is reported as a TRU-Contaminated Soil/Mixed Site. It has no Hazardous Ranking System Migration Score (BHI 1994).

The ditch began at a point about 760 ft southeast of the 234-5Z Building and 450 ft west of Camden Avenue and ran in a southwesterly direction to the 216-U-10 Pond into which it drained. It lay parallel to and between the 216-Z-1D Ditch and the 216-Z-20 Crib.

216-Z-19 is described as an open ditch, 2,765 ft long and 4 ft wide at the bottom. It was 4 ft deep, 666 ft above MSL, and about 180 ft above groundwater (BHI 1994).

Its first 120 ft from the fallout of the 231-Z cooling water pipeline is common with the old 216-Z-1D and 216-Z-11 Ditches. The next 425 ft to the south is common with the 216-Z-1D Ditch. Its history is described by Maxfield (1979) as follows:

> "In April of 1971, excavation was started on the 216-Z-19 Ditch as a replacement for the contaminated 216-Z-11 Ditch in use at that time. The excavation was mistakenly started directly over the old buried 216-Z-1 Ditch near the confluence of the 234-5 cooling water stream with the 216-Z-11 Ditch (just south of the water sampler station and 120 ft south of the 231-Z stream fallout) Approximately 425 ft of the contaminated 216-Z-1 covered ditch was dug up before the mistake was noticed. At that point, the new 216-Z-19 Ditch was turned to the West from the 216-Z-1 covered ditch and followed a new route approximately 35 ft west of and parallel to the 216-Z-1 Ditch. It continued on this course until just before reaching 16th Street where it was redirected east under the 216-Z-11 Ditch road culvert. This routing was used with moderate success until October 1971 when a new culvert was installed 50 ft west of the 216-Z-11 culvert. The remainder of the 216-Z-19 Ditch was then dug from that point to the 216-U-10 Pond, a distance of approximately 1000 ft. Soil from the 216-Z-19 Ditch excavation was used to cover the old 216-Z-11 Ditch."

This document further notes that:

> "The first 120 ft of the 216-Z-19 Ditch from the fallout of the 231-Z cooling water pipeline is common with the old 216-Z-1 and 216-Z-11 Ditches. The next 425 ft

running south is common with the 216-Z-1 Ditch. The remainder of the 216-Z-19 Ditch to the 216-U-10 Pond was completed in the fall of 1971."

"An estimated 30 to 60 grams of alpha activity were accidently released March 25, 1976 from the Z-Plant complex into the 216-Z-19 Ditch and 216-U-10 Pond. The waste water discharge from 234-5 was subsequently reduced to approximately one third of the normal flow, and measures were initiated to control the radioactivity in the ditch from further spread. Three dams placed at intervals along the length of the ditch raised the ditch water level to inundate the contaminated ditch water line and also stopped the water flow from reaching the U-10 Pond. A water sprinkler system was installed to keep the bottom of the ditch, between the last dam and the pond, from drying out."

"The ditch, under the water, is grossly contaminated with plutonium and americum at the head end, but diminishes to a few hundred d/m per 100 cm^2 surface as it approaches the 216-U-10 Pond. Heavy growth of plant life within the ditch and along the banks help in preventing redeposition of the contamination by wind action." (Maxfield 1979)

Deactivation and stabilization of the 216-Z-19 Ditch, and others, is described in 216-Z-1D Ditch above.

Aliases for the 216-Z-19 Ditch include 216-U-10 Ditch and Z Plant Ditch.

The 216-Z-19 Ditch is described in Hanford drawings H-2-00576; H-2-10011; H-2-14035; H-2-32528; H-2-34762, Sheet 1. It is also shown in Hanford photograph 122440-171CN.

Unplanned releases associated with 216-Z-19 include UPR-200-W-110.

8.7 216-Z-20 CRIB

The 216-Z-20 Crib is an active waste facility constructed in 1981 to replace the 216-Z-11 Ditch as a low-level liquid waste disposal site for various PFP (Z Plant) facilities (BHI 1994; DOE-RL 1991b).

The crib received 3.8 X 10^9 L of cooling water, steam condensate, storm sewer, building drain, Hanford Engineering and Development Laboratory (HEDL) Radioactive Acid Digestion Test Unit (RADTU) cooling water, and chemical drains from the 234-5Z Building; cooling water steam condensate and lab drains wastes from the 231-Z Building; and miscellaneous drain waste from 291-Z, 232-Z, 236-Z, and 2736-Z Buildings (DOE-RL 1991b; Thies 1981; BHI 1994).

The site is classified as a low-level waste facility and has no Hazardous Ranking System Migration Score (BHI 1994).

Located in Hanford's 200-UP-1 Operable Unit, the crib is located a few ft west of, and parallel to, the backfilled 216-Z-19 Ditch. Its center line extends from Hanford coordinates N37830 W76523 to N39280 W76130. Hanford drawing H-2-44511, Sheets 86, 78, and 71 describe its location with respect to other facilities.

Hanford drawing H-2-92061 describes this crib as being constructed of three parallel 6-in. polyvinyl chloride (PVC) distribution lines lying 3.5 ft apart. They are perforated and run parallel for the entire 1,519 ft length of the crib. Depth below grade varies from 9 to 29 ft. Sets of risers extend from the distribution lines to a point 1.5 ft above grade at four locations. The distribution lines lie in a 2.5-ft deep bed of gravel that was covered with PVC sheeting before backfilling.

The crib is fed by two incoming lines. Manhole access exists at two points near the upper, or northern, end of the crib where the two incoming feed lines connect to the distribution lines. The northernmost feed line is 18-in. vitrified clay pipe (VCP) while the second line is 15-in. VCP. A 12-in. corrugated metal pipe that originally crossed the path of the crib has been terminated and capped on each side of the crib in the general area of the incoming feed lines at the north end of the crib. See details I, II, and III on Hanford drawing H-2-92061.

Several known releases have occurred at this site, including "on February 2, 1986, a release of .02 μCi/L alpha (amount unknown) occurred to this unit from 234-5Z Building tank leakage. On December 20, 1984, a release of 107 μCi/L unknown radionuclides (amount unknown) occurred to this unit from 234-5Z Building tank leakage. This unit received a spill of 7,594 lb of nitric acid on September 26, 1985." (BHI 1994; DOE-RL 1991b)

Aliases for the 216-Z-20 Crib include Z-19 Ditch Replacement Tile Field (BHI 1994).

The WIDS (BHI 1994) reports the following radionuclides deposited to this crib, decayed through December 12, 1989:

^{241}Am: 1.01 Ci	^{239}Pu: 2.03 Ci	^{106}Ru: 1.07 E-004 Ci
^{137}Cs: 8.64 E-002 Ci	^{241}Pu: 2.51 Ci	^{90}Sr: 6.63 E-002 Ci
^{238}Pu: 1.53 E-002 Ci		

Plutonium:	1.480 E-001 g
Alpha:	2.220 E+000 Ci
Beta:	4.090 E-001 Ci

An Unusual Occurrence Report, 84-85, dated December 21, 1984 describes a contamination incident at the PRF that contaminated the 216-Z-20 Crib. Waste stream contamination of 1.07 μCi/L was reported but no volumes were estimated.

Another Unusual Occurrence Report, 85-03, reports a second PRF contamination incident that reached the 216-Z-20 Crib. Waste stream effluents were measured at 2.32 and 1.28 μCi/L were measured. No volumes were estimated.

An undocumented note to file exists in the WIDS "Hard Files" (BHI 1994) that describe a November 21, 1986 Z Plant incident wherein "Floor wax and paint were inadvertently poured into the floor drains that feed the 216-Z-20 Crib. The crib has been extensively fouled and plugged."

Wheeler (1985) reports a cave-in problem at 216-Z-20 Crib. It reports:

> "Cave-ins have been discovered at waste disposal sites since the thaw began in February. To date, cave-ins have been documented... at 216-Z-20 Crib... where, theoretically, no cave-in potential exists. The cause has been attributed to a "washout" of fine particles through gravel leaving a void behind, resulting in a later collapse... The number of cave-ins found demonstrates that a safety hazard can exist over any waste disposal site, not just those with wooden structures."

High liquid levels were recorded in 216-Z-20 Crib observation wells in the Fall of 1986. A geological evaluation indicated that the crib is underlain by a layer of silty fine sand. Beneath that layer, a layer of course sand exists that appears to start at a depth of 15 to 20 ft beneath the ground surface. To improve the crib percolation rate, crib drains were proposed to direct effluent to the layer of coarse sand.

Commencing in March 1987, thirty 2-in. drains were drilled along the edge of the crib to a depth of 25 ft below grade. In July 1987, seven 12-in. drains were drilled through the crib between the distribution pipes to a depth of 25 ft below grade. After drilling, the drains were backfilled with coarse gravel and the casings were removed (Work Plan TFPE-YP-0025 and Drawing ECN's).

8.8 216-S-4 FRENCH DRAIN

This unit consists of two French Drains with 30-in.-diameter rock-filled encasements. The encasements are metal culvert pipe placed end-to-end to a depth of 20 ft. It was active from August 1953 to August 1956 and received 1M L of waste from the condensers on the 101-S and 104-S tanks. It is located in the 200 West Area 307 ft north of 13th Street, between the 241-S Tank Farm and the 216-U-10 Pond (Hanford coordinates N36070 W76615 [center]) (BHI 1994; Hanford drawings H-2-74443; H-2-44510, Sheet 9; H-2-44511, Series; photograph A-17, Appendix A).

Until 1953, the site received condensate and cooling water from condensers on the 101-S and 104-S tanks. After 1953, it received only cooling water. It was retired when the tank air condensers were reactivated in August 1956 and was deactivated by removing the above ground piping.

The marker "216-S-4 Crib" appears to have been placed too far south of the site (BHI 1994).

Aliases for this site are the 216-S-7, 216-S-4 Sump or Crib, and UN-216-W-1 (BHI 1994).

8.9 216-S-21 CRIB

The 216-S-21 Crib is an inactive crib 2,736 ft northwest of the 202-S Building, 150 ft north of 13th Street, and west of the 241-S Tank Farm at Hanford Site coordinates N35920 W76400. From 1954 to 1969, the site received 241-SX condensate from the condensers in the 401-SX Condenser Facility via the 206-SX Tank in the 241-SX Tank Farm. The Site was retired in February 1969. The waste is low salt and neutral/basic (BHI 1994).

The unit is a 16-ft by 15-ft by 9-ft 10-in. wooden structure, 8.25 ft below grade with a side slope of 1:1. The bottom of the wooden structure is 4 ft above the bottom of the unit at N35970. The bottom

of the wooden structure is 4 ft above the bottom of the unit, suspended in gravel fill. The site dimensions are 50 ft by 50 ft by 21 ft deep. The ground elevation is 661 ft above MSL and the water table depth is 180 ft below grade. The mixed liquid waste volume received is 87,100,000 L. The chemicals disposed were sodium and ammonium nitrate. The contaminated soil volume is 1,100 m^3. The overburden soil volume is 2,200 m^3 (BHI 1994).

Radionuclide inventory for this site includes 23.9 Ci of ^{90}Sr, 93.2 Ci of ^{137}Cs, and 226 Ci of Beta (BHI 1994).

Aliases for 216-S-21 are 216-SX-1, 216-SX-1 Cavern or Crib (BHI 1994).

Environmental monitoring data indicate breakthrough to groundwater has not occurred at this site. Surveillance as of August 1990 shows there is a cave-in potential and only the perimeters were surveyed. Prompt remedial action would be required to prevent spread of contamination and correct other hazards (BHI 1994).

8.10 2607-W-9 SEPTIC TANK

The 2607-W-9 Septic Tank and tile field began service in 1950 and is currently active. It has served the 2707-SX Building since 1950. The estimated rate of waste generation is 1 m^3/day.

The septic tank and tile field are northwest of the 2707-SX Change House, at coordinates N35590 W76130. A gravel surface covers the septic tank and Tile Field. Two posts with a sun bleached sign mark the location of the tile field. The exact location of the Septic Tank is not known from the surface. It has a capacity of 500 gal (DOE-RL 1991b).

The specific dimensions of the septic tank cannot be found. Its location is shown on Hanford drawing H-2-39930.

The tile field is about 35 ft long and 10 ft wide. It is about 6 ft deep, the bottom 2 ft being filled with gravel. It is backfilled to grade. A single 6-in. pipe runs down the center of the tile field.

The location of this site is shown on Hanford drawing H-2-39930. A typical section of the tile field is shown on Hanford drawing H-2-63057.

8.11 UPR-200-W-18

This site is a duplicate of UPR-200-W-139 and is scheduled for deletion as a UPR (BHI 1994). UPR-200-W-139 is part of another operable unit and not reportable in this report.

8.12 UN-200-W-68

The UN-200-W-68 describes an unplanned release detected on February 8, 1972 near the intersection of Dayton Avenue and 13th Street at Hanford coordinates N35800 W78105. The cause of contamination was not conclusively determined. Unknown beta/gamma contamination with readings from 5,000 to 80,000 cpm were identified (BHI 1994; Stenner et al. 1988).

8.13 UPR-200-W-104

The UPR-200-W-104, UPR-200-W-105, UPR-200-W-106, and UPR-200-W-107 are somewhat unusual in that they describe trenches that were intended to receive contaminated water and releases into them were not actually unplanned.

The UPR-200-W-104 is one of three trenches intended to give additional leaching surface for overflow water from the 216-U-10 Pond. It was dug in the mid 1950's. Survey of the UPR-200-W-104 Trench (apparently during excavation) showed low contamination levels of beta/gamma and alpha contamination from an unknown source. Hanford drawings H-2-34762, Sheet 1; H-2-44510, Sheet 9, describe the site.

The trench is 580 ft long with a width of 40 ft and a depth of 10 ft. It extends northeast from the northeast corner of the 216-U-10 pond, at Hanford coordinates N36880 W77075 to N37090 W76520.

The ground elevation for the site is 648 ft above MSL and the water level is 185 ft below grade (Maxfield 1979).

Site monitoring in 1978 determined that Geiger-Mueller (GM) readings in the bottom of the trench were generally 2,000 cpm of beta/gamma activity.

The following concentrations of various contaminants were found:

Sample Location	Concentrations in pCi/g (Dry Weight)					
	^{40}K	$^{89/90}Sr$	^{137}Cs	^{144}Ce	^{155}Eu	^{241}Am
East end of trench	19.1	2.8	1,870			
Middle	14.7	4.9	324	4.6	2.8	1,670
West end	13.3	5.2	275	6.5	3.3	28,000

Aliases of this site are UN-216-W-14 and 216-U-10 Pond Leach Trench (BHI 1994). See BHI (1994) for complete WIDS description of UPR.

8.14 UPR-200-W-105

The UPR-200-W-105 is one of three trenches excavated to give additional leaching surface for overflow water from the 216-U-10 Pond. The trenches were dug in the mid 50's. Survey of the UPR-200-W-105 trench (apparently during excavation) showed low contamination levels of beta/gamma and alpha contamination from an unknown source (Maxfield 1979; Hanford drawings H-2-34762, Sheet 1; H-2-44510, Sheet 9).

The UPR-200-W-105 Trench is approximately 500 ft long, 45 ft wide, and 15 ft deep. It is located directly east from the center of the east side of 216-U-10 Pond, at Hanford coordinates N36585 W76948 to N36560 W76440 (Maxfield 1979). Its exact location is shown on Hanford drawing H-2-44511, Sheet 55.

The trench bottom was monitored in 1978 and readings were generally 2,000 cpm in the east end of the trench and 3,000 cpm in the west end. Samples were collected from the surface soil in the bottom of the trench and results of analysis were as follows:

Sample Location	Concentrations in pCi/g (Dry Weight)				
	^{40}K	$^{89/90}Sr$	^{137}Cs	^{144}Ce	^{155}Eu
East end of trench	15.2	40.2	1,010		
Middle	14.1	80.2	1,620		
West end	13.6	38.8	2,030		1.1

Aliases of this site are UN-216-W-15 and 216-U-10 Pond Leach Trench (Maxfield 1979).

See BHI (1994) for complete WIDS description of UPR.

8.15 UPR-200-W-106

The UPR-200-W-106 is an inactive leach trench that runs east from the east side of the 216-U-10 Pond, a little south of UN-216-W-15 Trench at Hanford coordinates N36320 W76810 to N36290 W76415. The trench was approximately 400 ft long, 25 ft wide, and 8 ft deep to give additional leaching surface for overflow water from the 216-U-10 Pond. There is low-level beta/gamma and alpha activity in the ground surface in the bottom of the leach trench.

The 1978 site environmental surveys have detected readings in the bottom of the trench were generally 2,000 cpm in the east end of the trench and 3,000 cpm in the west end. Analyses of soil samples taken from the ground surface of the bottom of the trench were as follows:

Sample Location	Concentrations in pCi/g (Dry Weight)		
	^{40}K	$^{89/90}Sr$	^{137}Cs
East end of trench	14.4	26.9	978
Middle	13.4	32.2	1,020
West end	13.3	58.5	1,350

Aliases of the UPR-200-W-106 are UN-216-W-16 and 216-U-10 Pond Leach Trench.

See BHI (1994) for complete WIDS description of UPR.

8.16 UPR-200-W-107

The UPR-200-W-107 is a flood plain that existed just south of the 216-U-10 Pond at Hanford Site coordinates N36000 W77700. It was inundated with rising water from the 216-U-10 Pond.

The flood plain was exposed by receding waters of the U-10 Pond. An environmental monitoring survey in January 1978 identified 8,000 cpm.

Analyses of soil samples taken from the ground surface of the flood plain in 1978 disclosed the following:

Sample Location	Concentrations in pCi/g (Dry Weight)				
	^{40}K	$^{89/90}Sr$	^{137}Cs	^{144}Ce	^{155}Eu
East end of trench	13.8	26.4	851		
West end	13.7	98.4	2,600	28.2	

Aliases of the UPR-200-W-107 are UN-216-W-17, 216-U-10 Pond Flood Plain, and 216-U-10 Pond Leach Trench.

See BHI (1994) for complete WIDS description of UPR.

8.17 UPR-200-W-110

The UPR-200-W-110 describes the mistaken excavation of the old 216-Z-1 Ditch during the construction of the 216-Z-19 Ditch. 425 ft of the 216-Z-1 Ditch that had been contaminated in 1959 with plutonium and americum were mistakenly exhumed in 1971 during the excavation of the upper end of the new 216-Z-19 Ditch.

Americum and plutonium contamination readings at the bottom of the ditch were 100,000 dpm. The area was backfilled with excavated soils and topped with clean soil (BHI 1994; Maxfield 1979; Stenner et al. 1988).

9.0 OPERABLE UNIT 200-UP-2

Operable Unit 200-UP-2 includes 25 waste sites and 17 UPR's. These include low-level liquid waste sites in the vicinity of the 221-U Canyon Building including cribs, French drains, a reverse well, trenches, ditches, catch tanks, settling tanks, septic tanks, and diversion boxes. All are associated with the operation of the 221-U Canyon Building and the 224-U UO_3 Plant. Additional waste sites include the 241-WR Vault, a construction surface laydown area, and a burn pit.

9.1 241-WR VAULT

Constructed in 1952 as part of the U Plant uranium recovery program modification, the 241-WR Vault is a 128-ft by 66-ft by 45-ft deep underground concrete structure that contains nine 50,000 gal storage tanks and associated pumps, valves, and agitators. These were used during U Plant operation (1952 through 1958) to store UNH for feed to 221-U, temporary storage of recovered nitric acid (HNO_3), and to hold TBP waste before routing to B Plant cribs and trenches. Following termination of U Plant operations in 1958, 241-WR was used to store HNO_3 and thorium from reduction and oxidation (Redox) and the PUREX Plant. HNO_3 was transferred by railroad tank car and thorium by truck (Knight 1990; Crusselle and Romano 1982; Hanford drawing H-2-40061).

A significant but unidentified contamination is reported to have occurred in the early 1960's when a tank overflowed and filled its cell. The tank may have held thorium. When the tank was subsequently pumped out, it became buoyant in the spilled liquid and floated loose from its base, rupturing its lines, jumpers, and mechanical connections. A significant cleanup effort was required to return the facility to service. The vault is reported to contain radioactively contaminated equipment and structure with an estimated contamination burden of 60 Ci beta (DOE-RL 1991b; Knight 1990).

The facility is now completely sealed. Aboveground structures, entry port, and vents have been dismantled and the facility sealed with a plasticized foam. All tanks and related equipment remain in place within the facility (BHI 1994; Hanford drawing SK-2-56951; Knight 1990).

Aliases for the waste unit include 241-WR Diversion Station Vault and Thorium Vault. Located at Hanford coordinates N38800 W72900, 241-WR Vault is 700 ft above MSL and 236 ft above water table. UNH, HNO_3, and TBP waste were transferred to the vault through underground transfer lines.

9.2 PROCESS LINES AND ENCASEMENTS

Process lines are not included in this operable unit, but are described here because they pass through the unit and have been essential to the operation of 221-U Canyon Building, 224-U, 241-WR Vault, and related tank farms.

Process lines, sometimes referred to on drawings as transfer lines or process sewer lines, connect the major process facilities with each other and with their waste handling facilities. Most are 3-in.-diameter stainless steel pipe with welded joints. Major process line groupings are enclosed in steel reinforced concrete encasements. Nearly all are below grade, some as deep as 15 ft. A few that pass between adjacent facilities are elevated above ground on wooden poles. Hanford drawing

H-2-2491, Sheet 3, shows most 200 West Area process lines on a single drawing. Multiple sheet Hanford drawings H-2-44510 and H-2-44511, provide greater detail and clearly identify encasements.

Encasements are concrete fixtures designed to protect from one to seven buried process lines. They vary in width, depending on the number of lines contained. The base portion is made of steel reinforced concrete that was formed and poured in place. Separate channels are sometimes provided for each process line, and the lines are raised from the encasement bottom by steel spacers. Steel plate of various design was sealed in place over the process line channels to form a water tight seal. A steel reinforced concrete upper portion, or encasement lid, was then sealed in place to form a second water tight seal and further protect the process lines. Riser pipes were provided to allow sampling of the interior of the encasement for contamination that might result from process line leakage.

Encasements protect multiple process lines running between S, T, and U Plants and the 241-S, T and U Tank Farms. Diversion stations at the three tank farms and at U Plant permit routing of process fluids to the different lines.

9.3 CONSTRUCTION SURFACE LAYDOWN AREA

The Construction Surface Laydown Area was a shallow pit used for disposal of unusable construction materials such as valves, piping, and plumbing materials. There is no evidence that any of the materials disposed of were radioactively or chemically contaminated.

Located southeast of the intersection of 16th Street and Beloit Avenue, this site is located at Hanford coordinates N37625 W72450 (center of pit). It was a 400-ft by 175-ft by 15-ft deep excavation into which trucks were driven to dump materials. Although drawings are referenced in Stenner et al. (1988), none have been located that show the pit. Aerial photographs of the area show its approximate location and size (BHI 1994; Stenner et al. 1988; Hanford photograph 5998-1.

The area of the pit was cleaned and grubbed in 1987 before construction of the 216-U-17 Crib whose dimensions partially encompass those of the pit.

No radionuclide or hazardous chemical inventories are available for this site.

9.4 207-U RETENTION BASINS

Located at Hanford coordinates N38000 W75200, the 207-U Retention Basins are 674 ft above MSL and 200 ft above water table (BHI 1994).

This waste unit consists of two concrete basins, each about 6.5 ft deep and holding about 1/2 Mgal. The bottom dimensions of each basin are 106 ft^2. Total dimensions of the unit are 246 ft by 123 ft (DOE-RL 1991a). Associated structures include inlet and outlet structures on the east and west sides, respectively, located outside of the basins. Also included are two sections of 16-in. concrete pipe, about 13 ft long, running to two 3 ft by 3 ft sumps, one for each basin (Hanford drawing W-73975).

Until 1972, the basins received steam condensate and cooling water from 224-U Building and chemical sewer waste from 221-U Building. Since that year, the basins have received only cooling water from 224-U Building. It was temporarily replaced by the 216-U-16 Crib, but was reactivated when U-16 shut down. Effluent is routed from the basin to the 216-U-14 Ditch (DOE-RL 1991b; Maxfield 1979).

In the 1960's, sludge was scraped from the north basin and buried in a 40-ft by 10-ft by 8-ft deep trench on the north side of the north basin (216-W-22). A similar action was taken to clean out the south basin and a similar burial trench is located immediately south of the south basin (216-W-21) (Maxfield 1979; UPR-200-W-111; UPR-200-W-112).

On August 6, 1986, about 800 gal of 50% reprocessed HNO_3 was released to the basin and subsequently to the 216-U-14 Ditch. The total release to the environment consisted of about 225,000 lb of corrosive solution (Ph less than 2.0) and 100 lb of uranium (DOE-RL 1991b; Stenner et al. 1988).

The north basin is overgrown with aquatic plant life. Surface contamination is measured at 200 to $>100{,}000$ cpm. No change in activity is reported since July 1987 (Osborne and Johnson 1988). No aliases are known for this waste unit. See Appendix B for radionuclide and hazardous chemical inventories.

9.5 216-U-1 AND 216-U-2 CRIBS

The 216-U-1 and the 216-U-2 Cribs will be treated together in this document because of their co-location and similarities. They are similarly treated in most reference materials.

Located at Hanford coordinates N37860 and W74242, 216-U-1 and 216-U-2 Cribs are 200 ft north of 16th Street and 1,000 ft east of the 207-U Basins in Hanford's 200 West Area (BHI 1994; Maxfield 1979).

These cribs sit side by side in an east/west orientation with overflow from 216-U-1 flowing to 216-U-2. Each is a 12-ft by 12-ft by 4-ft wooden structure constructed of 6-in. by 6-in. timbers. They rest upon undisturbed soil at the bottom of 20-ft deep backfilled excavation with 1:1 side slopes. Gravel fill was not used. The cribs are about 60 ft apart and are connected by a 3-1/2-in. stainless steel pipe. A 2-in. stainless steel vent pipe was installed but blanked off and replaced at a later date with a 1/4-in. stainless steel line that extends downward from the surface to within 1 ft of the bottom of each crib. An 8-in. black iron test well casing also extends from the surface, through the center of each crib structure, downward to a depth of 70 ft. All wastes flowed to these cribs from the 241-U-361 Settling Tank, located about 80 ft east of 216-U-1 (Hanford drawings H-2-50061; H-2-44511, Sheet 61).

Constructed in 1951, these cribs operated from 1951 through 1967, receiving liquid waste from the 221-U and 224-U Buildings. Waste history is described in the WIDS database (BHI 1994) and Maxfield (1979) as follows:

> "From 3/52 (Crib 2) to 6/57, the site received cell drainage from Tank 5-6 in the 221-U building and waste from the 224-U Building via the overflow from the 241-U-361 Settling Tank. From 6/57 to 7/57, the site received waste from the 224-U Building via

> the overflow from the 241-U-361 Settling Tank and contaminated solvent from the 276-U Settling Tank Storage Area. The discharge of 221-U waste was discontinued during shutdown of production operations. From 7/57 to 5/67, the site received waste from the 224-U Building and equipment decontamination and reclamation wastes from CPD Services Operations in the 221-U Building canyon. Crib 2 was deactivated in 5/67. The waste was low salt and neutral/basic."

Records indicate that 4,040 kg of uranium were discharged to the cribs between 1957 and 1967 which became insoluble as it reached the sediments by reacting with carbonate to form a carbonate-phosphate compound. Acid wastes discharged to the cribs between 1957 and 1967 reacted with the uranium complexes to form compounds that are both soluble and nonsorbing in the sediments. While the acid had mobilized the uranium, the volume of fluid discharged was inadequate to transport the uranium in significant quantities to the water table.

A new crib, 216-U-16, was installed a few hundred feet south of the 216-U-1 and 216-U-2 Cribs. Liquid discharges to 216-U-16 were sufficient by early 1985 to form a pond above a caliche layer (about 165 ft below the surface), move laterally below the 216-U-1 and 216-U-2 Cribs, and transport the uranium through holes in the caliche layer to the water table. In February 1985, it was discovered that uranium concentrations in the groundwater below the cribs had abruptly increased from a background of about 166 pCi/L to about 72,000 pCi/L.

Three actions were taken to remedy the discharges of uranium to the groundwater. Groundwater was pumped through an ion-exchange column to remove uranium. Portions of existing wells were grouted to prevent vertical groundwater communication. And new monitoring wells were installed to aid in characterizing the uranium plume and its cleanup. 8 Mgal of groundwater were pumped and treated removing 687 kg of uranium. Uranium contamination, as measured at nearby wells, was reduced from 72,000 pCi/L to about 17,000 pCi/L (Baker et al. 1988).

A spill occurred in the vicinity of 216-U-1 and 216-U-2. Baldridge (1959) reports as follows:

> "Organic wastes and cell drainage from the TBP and UO_3 plants overflowed to the ground by way of the tank and crib vents in the spring of 1953. Ground contamination up to 11.5 Rads/hour at 3 in. was found over an area of approximately 50 ft^2. Decontamination was attempted and the area was then backfilled, delimited with a wooden fence, and posted with radiation zone signs." (See UN-200-W-19).

Aliases for 216-U-1 and 216-U-2 include 361-WR, 216-U-3, and 216-UR-1 and 216-UR-2 Cribs. See Appendix A for photographs and Appendix B for radionuclide and hazardous chemical inventories.

9.6 216-U-3 FRENCH DRAIN

Although currently listed as a french drain, 216-U-3 is described on drawings as a crib, which description is probably more accurate. It is located just south of the 241-U Tank Farm at coordinates N37620 W75630. It is a 12-ft deep rock filled excavation with a 6-ft-diameter bottom and side slopes of 3:1. It has no fabricated sides as a french drain might have. A 2-in. steel line enters the drain from the northeast at a depth of 7 ft and a 4-in. black steel pipe extends upwards to a cap 12 in. above the surface. The drain is a registered underground injection well.

The drain received condensate from the 241-U steam condenser on the 241-U-104 and 241-U-110 waste tanks at the 241-U Waste Tank Farm from 1954 to 1955. 7.91 X 10^5 L of low salt, neutral/basic condensate are estimated to have been pumped into the drain. See Appendix B for radionuclide and hazardous chemical inventories (BHI 1994; DOE 1988; Maxfield 1979, Stenner et al. 1988; Hanford drawings H-2-44004, Sheet 1; H-2-74442; H-2-44511, Sheet 62).

The drain is best described on Hanford drawing H-2-44004, Sheet 1 while its location is described on H-2-44511, Sheet 62. Hanford drawing H-2-74442 also accurately locates the drain, but mistakenly shows a 4-in. black iron pipe running from the drain to the 216-U-14 Ditch. Photographs are included in Appendix A. Aliases for this site include 216-U-11.

9.7 216-U-4 REVERSE WELL

The 216-U-4 Reverse Well is a 3-in.-diameter steel pipe that extends 75 ft beneath the surface. The bottom 25 ft are perforated and the bottom end is nearly closed by flattening. It received 300,000 L of decontamination waste from the 222-U Laboratory hood sinks from 1947 to 1955 that are described as acidic plutonium and fission product waste. It was reportedly deactivated in 1955 when it began to plug and an overflow line to the newly constructed 216-U-4A French Drain was installed. Baldridge (1959) reports that the pipe has been sealed off above ground level but is not posted as a radiation zone. A site inspection found that two warning markers have been installed. 216-U-4 is a registered injection well.

Aliases for this site include 222-U Dry Well, 222-U-110 Dry Well, 216-U-2 and 216-U-4 Dry Wells. Clukey (1956) refers to the combination of well and drain as the "222-U-110 Reverse Well and French Drain."

The 216-U-4 is located 17 ft west and 2 ft north of the west corner of the 222-U Laboratory Building, at Hanford coordinates N38209 W73218. It is immediately inside the UO_3 exclusion area fence and may be seen but not approached from the direction of the 222-U Building. An "Underground Radioactive Material" marker is attached to the portion of pipe that extends above ground and a concrete post with identification plate reading "216-U-4 Crib" is installed between the well and the drain. Its location is described on Hanford drawings HW-69870, Sheet 2; H-2-50183, Sheet 2; H-2-44511, Sheet 68. Detail is provided on Hanford drawings H-2-50183, Sheet 2 and HW-69870, Sheet 2, Detail A-A.

See Appendix B for radionuclide and hazardous chemical inventories. Photos are included in Appendix A (BHI 1994; Stenner et al. 1988; Baldridge 1959; Clukey 1956; Maxfield 1979; Hanford drawings H-2-44511, Sheet 68; H-2-50183, Sheet 2; HW-69870, Sheet 2).

Two issues relating to 216-U-4 may prove confusing to the researcher. First is that of its deactivation. This author finds no evidence that any overt steps were taken to deactivate the well. When it began to plug (i.e., failed to percolate liquids in 1955) the 216-U-4A French Drain was constructed adjacent to the well and an overflow line installed between the well and the drain. No evidence exists that any steps were taken to seal off the well. If the well were fully plugged, all waste liquids entering the top of the well would flow through the overflow line into the french drain. If, however, the well were only partially plugged, or if it became unplugged over time, some quantity of wastes would continue to pass to the soil column through the well, the balance passing to soil through the french drain but at a much shallower depth.

Secondly, the waste units are misidentified on at least one drawing. Hanford drawing H-2-50183, Sheet 2, mislabels the 216-U-4 Reverse Well as the 216-U-4A French Drain. This author has verified the error by a site inspection. Other than this error, Hanford drawing H-2-50183, Sheet 2, appears to provide the best description of the waste units and their overflow relationship.

9.8 216-U-4A FRENCH DRAIN

The 216-U-4A French Drain was installed in mid 1955 to receive 222-U Laboratory hood sink decontamination wastes when the 216-U-4 Reverse Well began to plug. The drain was installed 8 ft north of the well and the two were connected by an overflow line.

Located about 15 ft west of the west corner of the 222-U Laboratory Building, 216-U-4A is a 51-in. concrete pipe that extends downward 4 ft (minimum) and whose upper surface is 5 ft below grade. Its top is covered with a 5-in. thick wooden lid. The drain rests on undisturbed soil and is not gravel filled.

A 3-in. stainless steel line runs from the 216-U-4 Reverse Well to the drain, entering the drain a few inches below its lid.

The drain is located immediately outside the UO_3 exclusion area security fence. It is unmarked, but the adjacent 216-U-4 Reverse Well is marked with an "Underground Radioactive Material" marker attached to the portion of pipe that extends above ground and a concrete post with identification plate reading "216-U-4 Crib" is installed between the well and the drain. Its location is described on Hanford drawings H-2-36850; H-2-44511, Sheet 68; H-2-50183, Sheet 2. Details are provided on Hanford drawing H-2-50183, Sheet 2, Detail A-A.

From 1955 until 1970, the drain received 545,000 L of acidic plutonium and fission product decontamination waste. See Appendix B for radionuclide inventory and hazardous chemical inventory. Photographs are included in Appendix A. Aliases for this site include 222-U Dry Well, 222-U-110 Dry Well, and 216-U-2 Crib (BHI 1994; Stenner et al. 1988; Clukey 1956; Maxfield 1979; Hanford drawings H-2-44511, Sheet 68; H-2-50183, Sheet 2).

9.9 216-U-4B FRENCH DRAIN

The 216-U-4B French Drain was installed in January 1960 to receive liquid wastes from the 222-U Laboratory. A registered underground injection well, the drain is a 36-in. concrete pipe that extends 10 ft beneath the surface. Operating until 1970, it received 33,000 L of low salt, neutral-basic 222-U Laboratory hot cell, and hood wastes.

It is located 30 ft south of the 222-U Laboratory rear wall at Hanford coordinates N38248 W73100. It was vented with a 1-in. steel riser pipe that is now capped. The site is currently marked with four concrete posts and a steel chain with "Underground Radioactive Contamination" warning signs attached.

The site location is described on Hanford drawings H-2-44511, Sheet 68; H-2-34762, Sheet 1; SK-2-3337. No drawings have been identified that offer construction details.

See Appendix B for radionuclide and hazardous chemical inventories. Aliases for this site include 216-U-4B Dry Well.

Photographs are included in Appendix A (BHI 1994; Stenner et al. 1988; Clukey 1956; Maxfield 1979).

9.10 216-U-5 AND U-6 TRENCHES

The 216-U-5 and the 216-U-6 Trenches will be treated together in this document because of their co-location and similarity of function. No structures exist in either waste unit. Both are excavations that have been backfilled and all piping removed.

The 216-U-5 and 216-U-6 Trenches are located immediately northwest of the 241-WR Vault and north of the east end of the 221-U Canyon Building (Hanford drawing H-2-32527).

Both waste units were excavated in March 1952, to receive unirradiated uranium waste from the cold start-up run at U Plant (221-U Building). The liquid waste was transferred to the trenches by way of above-ground pipes that were removed at the conclusion of the waste transfer. Both trenches were then backfilled (March 1952) and the sites posted with barriers and signs.

The 216-U-5 Trench, when opened, had a 40-ft by 40-ft bottom surface and was 10 ft deep. The 216-U-6 Trench had a 10-ft by 75-ft bottom surface and was also 10 ft deep.

2,250,000 L of waste containing 360 kg of unirradiated uranium were pumped into each trench (Stenner et al. 1988; Mayfield 1979). Another reference cites the amount of uranium as 16,000 lb, presumably 8,000 lb into each trench (Baldridge 1959).

See Appendix B for radionuclide and hazardous chemical inventories. Available drawings include H-2-32527; H-2-44510; H-2-34762, Sheet 1; H-2-57210; H-2-74443. Additional descriptive documents include Anderson (1973); Maxfield (1979); and Clukey (1956).

Photographs are included in Appendix A. Aliases for this waste site include 216-U-4 and 216-U-5; 221-U Cold Uranium Trench; and 221-U Cold Uranium Grave #1 and #2.

9.11 216-U-7 FRENCH DRAIN

The 216-U-7 French Drain is located 8 ft south of the 221-U Counting Box to which it is connected. It is a gravel filled 30-in. concrete pipe extending 17 ft downward in 3-ft sections. It received liquid wastes from the counting box floor drain from 1952 through 1957 during the metal recovery program at 221-U Canyon Building. Its top extends a few inches above grade and is capped with a wooden cover.

The french drain is connected to the counting box by a 3-in. schedule 40 steel drain pipe that intersects the drain 13 ft below grade and extends 6 in. into the drain. It is fully described in Detail L of Hanford drawing H-2-43078 (BHI 1994; Hanford drawings H-2-43078; H-2-43039).

One Hanford drawing, H-2-44511, Sheet 67, incorrectly identifies the 221-U counting box as the 291-U blower pit, thereby suggesting that the 216-U-7 drain supports the wrong facility. Detailed drawings indicate that 216-U-7 is connected to the 221-U counting box and the blower pit floor drain to the 241-WR Vault (Hanford drawings H-2-44511, Series; H-2-43078; H-2-40887).

Confusion exists concerning the relationship between 216-U-7 and UPR-200-W-138. UPR-200-W-138 describes a spill of about 300 lb of uranium, in UNH form, into the "vessel vent blower pit" and through its floor drain into the 216-U-7 french drain. The above mentioned detailed drawings show that the 216-U-7 french drain is connected to the 221-U counting box, not to the blower pit, and the blower pit drains to tank 1 in the 241-WR vault (BHI 1994; Maxfield 1973; Baldridge 1959; Stenner et al. 1988).

In addition to the drawings mentioned, this author has reviewed Anderson (1973); Maxfield (1979); and Clukey (1956); and Maxfield (1973) and found insufficient detail to resolve this confusion. It may be best resolved through interviews with knowledgeable personnel. Until the issue is resolved, it should be assumed that 300 lb of uranium were introduced to the soil through the 216-U-7 Drain.

Available drawings include H-2-43039 for waste site locations; H-2-43078 for detail of the french drain and its connection to the 221-U counting box; and H-2-40887 for detail of the 291-U blower pit. These, in turn, reference additional detail drawings. Hanford drawing H-2-44511, Sheet 67, also shows waste site locations but contains the above mentioned error.

Aliases for this site include UN-216-W-11 and 221-U Vessel Vent Blower Pit French Drain. See Appendix A for photographs and Appendix B for radionuclide and hazardous chemical inventories.

9.12 216-U-8 CRIB

The 216-U-8 Crib consists of three timber crib structures within a north/south gravel filled trench 160 ft long and 50 ft wide. The center point of the crib is located at Hanford coordinates N36860 W763100, about 450 ft west of Beloit Avenue and 750 ft south of 16th Street.

Each structure is a 16-ft by 16-ft by 10-ft timber crib constructed of 6-in. by 8-in. Douglas fir timbers resting on a 3-ft thick gravel bed, about 31 ft below grade. The cribs are 60 ft apart, connected in series by a 6-in. schedule 40 steel pipe. Each pipe is supported at two points by a wooden pipe support. Each timber crib was vented by two 4-in. schedule 40 steel pipes that have since been capped below grade.

A test well constructed of 8-in. schedule 40 pipe extends from 2 ft above grade to a depth of 50 ft through the center of each crib.

The waste line to the crib is a 6-in. VCP protected by a 12-in. concrete encasement. A total of approximately 378,000 L of acidic process condensate from 221-U and 224-U Buildings, and the 291-U Stack drainage system were discharged to the crib.

In 1960, the 216-U-8 Crib was deactivated when subsidence was observed around the vent risers. The incoming line was blanked off at a point about 60 ft north of the crib. Liquid wastes were thereafter diverted to the 216-U-12 Crib (BHI 1994; Maxfield 1979; Hanford drawings H-2-43027; H-2-43028; H-2-43057; H-2-44511, Sheet 52).

Aliases for this site include 216-U-9, 216-WR-1, 216-WR-2, and 216-WR-3 Cribs. See Appendix A for photographs and Appendix B for radionuclide and hazardous chemical inventories. This waste site reportedly holds the largest inventory of waste uranium of any 200 West Area crib (Baker et al. 1988).

9.13 216-U-12 CRIB

The 216-U-12 Crib is located southwest of the intersection of Beloit Avenue and 16th Street, at Hanford coordinates N36350 W73100. This is about 250 ft south of the 216-U-8 Crib and nearly in line with it.

It consists of a 150-ft long gravel filled drain field that replaced the 216-U-8 Crib when it began to show signs of structural failure.

The crib is about 13 ft deep and contains no structure. Its bottom dimensions are about 100 ft by 10 ft and has natural earthen sides with a 2:1 slope. The bottom 7 ft are filled with graduated layers of sand and gravels that are covered with a polyethylene barrier. A perforated 12-in. VCP runs the length of the crib 10 ft beneath the surface and 3 ft above bottom. A 13-ft long, 12-in. VCP pipe serves as a vent riser at the south end, extending from 10 ft beneath the surface to 3 ft above grade. Two 17-ft long VCP liquid level gauge wells also extend 3 ft above the surface. A 6-in. VCP waste line delivered waste to the crib from the point where the 216-U-8 Crib feed line was blanked off and diverted to the 216-U-12 Crib (BHI 1994; Hanford drawings H-2-31322; SK-2-17906).

Constructed in 1960, the 216-U-12 Crib received 150M L of liquid waste during its 28 years of use. Drainage was received from the 291-U Stack drainage system, 224-U process condensate system, wastes from the C-5 and C-7 tanks, and miscellaneous storm drain wastes from the 224-U Building.

McMurray (1965) reports that contaminated water containing 3.14 kg of thorium was received from the 244-WR Vault in October 1965. This appears to be an error and should have referred instead to the 241-WR Vault. There is no 244-WR Vault and 216-U-12 is connected, via diversion box, to the 241-WR Vault that stored thorium for a period of time (BHI 1994; Lundgren 1970; McMurray 1965; Maxfield 1979).

See Appendix B for radionuclide and hazardous chemical inventories.

The 216-U-12 Crib is a RCRA Site with a 1994 Tri-Party Agreement milestone for completion of a closure/post closure plan.

9.14 216-U-14 DITCH

The 216-U-14 Ditch is an open ditch running from northeast to southwest across about 1 mi of the 200 West Area. It has provided waste disposal for a number of 200 West Area facilities since 1944. Historically referred to as the "Laundry Ditch," it received liquid wastes from the 2724-W Laundry Building, but received a greater waste burden from other waste sources.

The 216-U-14 Ditch has a minimum bottom width of 8 ft, sides that slope at 2.5:1, and was 5,680 ft long before being partially backfilled. It originated 1,600 ft north of the 221-U Building, about

midway between 19th and 22nd Streets, and 700 ft west of Bridgeport Avenue, and terminated at the 216-U-10 Pond.

Approximately 3/4 of the unit has been backfilled. It now originates about 300 ft north of 16th Avenue and terminates about 300 ft west of Cooper Avenue, no longer flowing into the 216-U-10 Pond that has also been backfilled. A 48-in. by 150-ft long culvert allows the ditch to pass beneath 16th Street and a 24-in. culvert passes beneath 19th (BHI 1994; Maxfield 1979; Hanford drawing H-2-02430).

Waste types and amounts have varied over time. BHI (1994) reports the following:

> "From 7/44 to 9/44, the site received wastewater from the 284-W Powerhouse. From 9/44 to 1/50, the same plus waste from 2723-W. From 1/50 to 3/52, received waste water from 284-W and 2724-W Laundry building. From 3/52 to 5/54, the same plus chemical sewer waste from 221-U and cooling water from 224-U. From 5/54 to 8/55, the same plus cooling water from 241-U-110 condenser tank. From 8/55 to 11/73, the same plus 271-U cooling water. From 11/73 to 4/80, the same plus 242-S Evaporator condensate and cooling water. From 4/80 to 9/81, the same minus 242-S condensate, 2723-W and 2724-W waste. From 9/81 to 7/84, the same minus 221-U, 224-U, and 271-U waste. Since 7/84, the site has been receiving only 242-S Evaporator cooling water."

Baldridge (1959) reports that 150,000 gal/day of laundry water ran into 216-U-14 Ditch since 1955.

About 796 gal of 50% reprocessed HNO_3 was released to the unit on August 6, 1986. The total release to the environment consisted of about 225,000 lb of corrosive solution (pH less than 2.0) and 100 lb of uranium (DOE-RL 1991b).

The ditch is partially overgrown with grasses and various aquatic plants. Fresh water continues to be provided to the trench from a fire hydrant near the 242-S Evaporator Building via a 3-in. underground line.

Applicable Hanford drawings include H-2-94259; H-2-02430; M-2904-W; SK-2-17815. See Appendix B for radionuclide and hazardous chemical inventories.

9.15 216-U-15 TRENCH

The 216-U-15 Trench was a 20-ft by 20-ft by 15-ft deep excavation that was opened in May 1957 and backfilled immediately after receiving wastes.

Located at Hanford coordinates N38270 W73900, the 216-U-15 Trench is 550 ft north of 16th Street and 500 ft west of the 271-U Building (BHI 1994; Hanford drawing H-2-44511, Sheet 68).

The trench was opened to receive approximately 7,000 gal of interface crud, activated charcoal, and diatomaceous earth containing about 1 Ci of fission products from the 388-U Tank in the 276-U Solvent Storage Area. Wastes were pumped to the trench through above-ground lines that were removed after the waste transfer.

The exact nature of organic wastes received in this waste unit is unclear. DOE-RL (1988) reports 40,000 kg of Hexone and 13,000 kg of TBP while Stenner et al. (1988) reports 40,000 kg of paraffin hydrocarbon and 13,000 kg of TBP (DOE-RL 1991b; Stenner et al. 1988).

Maxfield (1979) provides radionuclide inventory data at time of discharge as follows:

Radionuclide	At Time of Discharge
Pu, g	0.1
Beta, Ci	7.0
^{90}Sr, Ci	0.1
^{106}Ru, Ci	1.0
^{137}Cs, Ci	0.1
^{60}Co, Ci	0.1
U, kg	2.3

No surface markers exist to identify the exact location of this waste unit.

See Appendix A for photographs and Appendix B for radioisotope and hazardous chemical inventories.

Data sources include BHI 1994; Stenner et al. 1988; Maxfield 1979; Baldridge 1959; Hanford drawings H-2-44510; H-2-34762, Sheet 1; H-2-44511, Sheet 68; and site inspection.

Aliases for this site include 388-U Tank Dump and U-152 Interface Crud Burial Site. See also UN-216-W-10, UN-216-W-125, and UN-216-W-158.

9.16 216-U-16 CRIB

Located south of 16th Street and midway between Beloit Avenue and Cooper Avenue, the 216-U-16 Crib is a large gravel filled drain field with no major structure other than a distribution box.

Located at Hanford coordinates N37209 W74376, 216-U-16 is 262 ft long, 191 ft wide, and 15 to 17 ft deep. Liquid wastes enter a 6-2/3 ft^2 distribution box and flow into a pair of 8-in. PVC header pipes that form the north, east, and west borders of the drain field. Connecting the header pipes are twenty-two 4-in. perforated drain pipes that run the width of the drain field, equally spaced, 3 ft above the bottom. Each drain pipe has a 4-in. vent pipe that extends to the surface. Three 6-in. gauge wells also extend to the surface.

The bottom is filled with gravel to a depth of 5 ft. Covering the gravel is a 36 mil reinforced polyethylene liner. A 6-in. subdrainage pipe runs the width of the unit at the west side (BHI 1994; Hanford drawings H-2-94255 through H-2-94258).

The crib received 224-U steam and process condensate and chemical sewer waste, 271-U compressor cooling water, and 221-U chemical sewer waste (BHI 1994). See Appendix B for radionuclide and hazardous chemical inventories.

Liquid discharges to this crib were sufficient by early 1985 to pool above a caliche layer (about 165 ft below the surface), move laterally northward below the 216-U-1 and 216-U-2 Cribs, and transport uranium from those cribs through holes in the caliche layer to groundwater. In February 1985, it was discovered that uranium concentrations in the groundwater below the 216-U-1 and 216-U-2 Cribs had abruptly increased from a background of 166 to about 72,000 pCi/L.

Pump-and-treat techniques were employed to treat 8 Mgal of groundwater, removing 687 kg of uranium and reducing contamination from 72,000 pCi/L to about 17,000 pCi/L (Baker et al. 1988).

Aliases for 216-U-16 include UO_3 Crib.

9.17 216-U-17 CRIB

The 216-U-17 Crib is an active underground gravel filled drain field located southeast of the intersection of Beloit Avenue and 16th Street, at Hanford coordinates N37575 W72480. It is oriented east to west and lies across the Construction Surface Laydown Area that was cleaned and grubbed before crib construction (Hanford drawings H-2-77174; H-2-77175).

Constructed in 1986, the crib was designed to replace the 216-U-12 Crib which had received its maximum allowed inventory of radioactive waste. The only discharge stream to the crib consists of UO_3 process condensate stream. This waste stream is monitored at the UO_3 facility and transported underground to the crib via a 6-in. polyethylene drain pipe. A neutralization system operates to maintain waste pH within a range of 2.0 to 12.5.

The crib is an 18-ft deep drain field that is covered with a 10 mil PVC membrane vapor barrier and backfilled. The drain field piping is designed to allow even flow over the entire crib from a distribution line within a 10-ft by 150-ft by 6-ft aggregate field. Three liquid-level wells are provided for monitoring the crib levels. Two vent risers are placed in the pipe header and contain deentrainers below ground level for protection against freezing, and for collection of any potential condensate (BHI 1994; Millikin 1987).

See Appendix B for an inventory of radionuclides that have been deposited in the crib.

The crib is protected by a chain barrier supported by steel posts. It is surveyed quarterly and no surface contamination has been discovered (Johnson and Huckfeldt 1990).

The site has no aliases.

9.18 224-U CONDENSATE NEUTRALIZATION TANK

The condensate neutralization tank is an active site, is not listed in the Tri-Party Agreement, and is mentioned here only because it is within the geographical limits of the operable unit and is mentioned in the WIDS data base (BHI 1994).

This facility continues in use in support of the PUREX and the UO_3 Plants. Located at the 224-U Building, it receives process condensate that is neutralized from an initial pH of 0.5 to a final pH of about 7.0 at a rate of 11,500 to 14,400 gal/day. Neutralization is accomplished using sodium hydroxide that is regulated by a pH feedback controller (BHI 1994).

9.19 224-U HAZARDOUS WASTE STORAGE AREA

The 224-U Hazardous Waste Storage Area (HWSA), like the neutralization tank mentioned above, is an active site that is not listed in the Tri-Party Agreement and is mentioned here only because it is within the operable unit and is mentioned in the WIDS data base (BHI 1994).

The HWSA is a paved pad located west of the 224-U Building that is used to store (stage) UO_3 Plant and PUREX related hazardous wastes before transport. Paint and solvents have been temporarily stored here.

9.20 241-U-151 DIVERSION BOX

The 241-U-151 Diversion Box is an active waste unit located about 100 ft northeast of the intersection of Camden Avenue and 16th Street at Hanford coordinates N37845 W75390. Associated with the 241-U Tank Farm, this unit is a 20-ft by 9-ft by 17-ft high concrete box with a floor drain connected to the 241-U-301 Catch Tank. It is buried to a depth of 17 ft and the upper surface of its 3-ft thick lid is at ground level. Multiple encased liquid waste transfer lines enter the box through its north wall. Liquid waste routing is made possible through the use of changeable jumper assemblies that connect pairs of waste transfer lines. Any leaks that occur are drained through the floor drain and, by gravity, through the drain line to the 241-U-301 Catch Tank located about 450 ft to the west (Hanford drawings H-2-02338, Sheet 8; HW-72182, Sheet 2).

High-level wastes passing to and from the 241-U Tank Farm pass through this waste unit. It has operated since 1946 (Hanford drawing HW-72182, Sheet 2; BHI 1994).

Fourteen 3-in. stainless steel transfer lines enter the diversion box. Two are connected directly to the 241-101 Tank in the 241-U Tank Farm. Others run to the 241-U-153 Diversion Box, to other tank farm facilities, and to various 200 West Area operations facilities. An additional 3-in. drain line runs from the floor drain to the catch tank (Hanford drawings H-2-02338, Sheet 8; H-2-44511, Sheet 62; HW-72182, Sheet 2).

Baldridge (1959) reports surface contamination around this waste unit. He states:

> "The ground around these boxes was contaminated in the spring of 1950 to a maximum observed dose rate of 20 mRads/hour at surface. The contamination was covered with 1

ft of clean soil and the area above ground delimited by a rope barricade posted with radiation zone signs." (See UN-200-W-6).

9.21 241-U-152 DIVERSION BOX

The 241-U-152 Diversion Box is an active waste unit located about 50 ft northeast of the intersection of Camden Avenue and 16th Street at Hanford coordinates N37800 W75400. Associated with the 241-U Tank Farm, this unit is a 28-ft by 9-ft by 17-ft high concrete box with a floor drain connected to the 241-U-301 Catch Tank. It is buried to a depth of 17 ft and the upper surface of its 3-ft thick lid is at ground level. Multiple encased liquid waste transfer lines enter the box through its north wall. Liquid waste routing is made possible through the use of changeable jumper assemblies that connect pairs of waste transfer lines. Any leaks that occur are drained through the floor drain and, by gravity, through the drain line to the catch tank that is located about 425 ft to the west (Hanford drawings H-2-44511, Sheet 62; H-2-02338, Sheet 9).

High-level processing and decontamination wastes passing to and from the 241-U Tank Farm pass through this waste unit. It has operated since 1946 (Hanford drawing H-2-02338, Sheet 9; BHI 1994).

Twenty-one 3-in. stainless steel transfer lines connect the diversion box to the 241-U-133 Diversion Box, to the 214-U Tank Farm facilities, and to various 200 West Area operations facilities. An additional 3-in. line runs from the floor drain to the catch tank (Hanford drawings H-2-02338, Sheet 9; H-2-44511, Sheet 62; HW-72182, Sheet 2).

Baldridge (1959) reports surface contamination around this waste unit. He states:

> "The ground around these boxes was contaminated in the spring of 1950 to a maximum observed dose rate of 20 mrads/hour at surface. The contamination was covered with 1 ft of clean soil and the area above ground delimited by a rope barricade posted with radiation zone signs." (See UN-200-W-6).

9.22 241-UX-154 DIVERSION BOX

The 241-UX-154 Diversion Box is an active waste unit located about 50 ft southeast of the 221-U Canyon Building near its R-7 exit at Hanford coordinates N38460 W73115. Associated with 221-U, it provides liquid waste routing to the 241-WR Vault and various tank farms, including waste units in the 200 East Area via the inter-area transfer line. It is a 52-ft by 6-ft by 11-ft high concrete box with a floor drain connected to the 241-UX-302 Catch Tank. It is buried to a depth of 11 ft and the upper surface of its 5-ft thick lid is at ground level. Multiple encased liquid waste transfer lines enter the box through its southeast wall. Liquid waste routing is made possible through the use of changeable jumper assemblies that connect pairs of waste transfer lines. Any leaks that occur are drained through the floor drain and, by gravity, through a drain line to a catch tank that is located 25 ft to the southwest. The diversion box and its catch tank are aligned in a southwest to northeast orientation (BHI 1994; Hanford drawings H-2-44511, Sheet 68; HW-72577, Sheet 2; H-2-00980; H-2-43082, Sheet 1).

High-level process and decontamination wastes passing between the 221-U Canyon Building and waste units, and between other process facilities and waste units, pass through this diversion box. Operating since 1946, it serves as a waste transfer hub not only for the 200 West Area, but also for the cross site waste transfers through the inter-area transfer line.

Twenty seven 3-in. stainless steel waste transfer lines connect the diversion box to the 221-U Canyon Building, catch tank, 241-U Tank Farm, 241-WR Vault, inter-area transfer lines, and 241-TX-155 Diversion Box. All lines except the floor drain line to the catch tank are encased in concrete encasements (BHI 1994; Hanford drawings H-2-43082, Sheet 1; H-2-44511, Series; H-2-43081).

Steel chain barricades and surface contamination warning signs are in place around this waste unit.

9.23 9.23 241-U-302 CATCH TANK

The 241-U-302 Catch Tank appears to be a duplicate entry in the list of 200-UP-2 waste units. It appears to duplicate the 241-UX-302 Catch Tank that is in approximately the same location as that listed in BHI (1994) for 241-U-302. No evidence can be found of a second catch tank in this vicinity nor is a waste unit with the 241-U-302 designator mentioned on drawings or applicable documents (see 241-UX-302 Catch Tank).

9.24 241-UX-302 CATCH TANK

The 241-UX-302 Catch Tank appears to be synonymous with the 241-U-302 Catch Tank. It is an active waste unit located 25 ft southwest of the 241-UX-154 Diversion Box from which it accepts liquid wastes that may spill and drain through its floor drain.

The 241-UX-302 Catch Tank is a 36-ft long by approximately 9-ft-diameter steel tank buried at a depth of about 4 ft (Hanford drawings H-2-00833; H-2-44511, Sheet 68).

Service dates are not available for this unit, but may be assumed to approximate those of the 241-UX-154 Diversion Box that it supports (i.e., 1946 to present), nor are radionuclide or hazardous chemical inventories available. It would have received wastes that may have leaked into the diversion box, potentially including high-level process waste and various decontamination and other wastes. No waste volume data has been identified.

Steel chain barricades and surface contamination warning signs are in place around this waste unit.

9.25 241-U-361 SETTLING TANK

The 241-U-361 Settling Tank is located southwest of the U Plant and 100 ft east of the 216-U-1 Crib at Hanford coordinates N37830 W74160. It served as a settling tank for fluid wastes enroute to the 216-U-1 and 216-U-2 Cribs from 1951 through 1967, receiving waste as follows:

> "From 3/52 to 6/57, the site received cell drainage from Tank 5-6 in the 221-U building and waste from the 224-U Building... From 6/57 to 7/57, the site received waste from the 224-U Building... and contaminated solvent from the 276-U Settling

> Tank Storage Area. The discharge of 221-U waste was discontinued during shutdown of production operations. From 7/57 to 5/67, the site received waste from the 224-U Building and equipment decontamination and reclamation wastes from CPD Services Operations in the 221-U Building canyon. The waste was low salt and neutral/basic." (BHI 1994; Maxfield 1979).

Records indicate that 4,040 kg of uranium were discharged to this waste unit between 1957 and 1967, the bulk of which necessarily overflowed into the 216-U-1 and 216-U-2 Cribs. It is currently estimated to contain 27,500 gal of sludge of unknown plutonium content estimated at 2,125 Ci beta/gamma (BHI 1994; DOE-RL 1991b).

The 241-U-361 Tank is a circular 20-ft-diameter by 19-ft deep structure made of 6-in. steel reinforced, prestressed concrete. Its top is 6 ft below grade. Several vent and liquid level measurement risers penetrate the surface (BHI 1994; Hanford drawing H-2-72183; site inspection).

A spill occurred in the vicinity of the 241-U-361 Tank. Baldridge (1959) reports as follows:

> "Organic wastes and cell drainage from the TBP and UO_3 plants overflowed to the ground by way of the tank and crib vents in the spring of 1953. Ground contamination up to 11.5 rads/hour at 3 in. was found over an area of approximately 50 ft^2. Decontamination was attempted and the area was then backfilled, delimited with a wooden fence, and posted with radiation zone signs." (See UN-200-W-19).

9.26 2607-W-5 SEPTIC TANK AND DRAIN FIELD

The 2607-W-5 Septic Tank and Drain Field are located 400 ft west of the southwest corner of the 221-U Canyon Building. It includes an underground septic tank, two distribution boxes, and two drain fields, referred to as tile fields on some drawings. It received sanitary wastewater and sewage from the 221-U Canyon Building, the 222-U Laboratory, the 224-U UO_3 Plant, and the 271-U Plutonium Storage and Services Building (BHI 1994; Hanford drawings H-2-44511, Sheets 68 and 69; M-2904-W, Sheet 19).

Operating from 1944 to the present, this active waste unit is located at Hanford coordinates N37825 W74050 (BHI 1994).

Its current drain field measures 136 ft by 100 ft and is buried 2-1/2 ft beneath grade. Drain field piping consists of "8-in. HEL-COR perforated pipe, 16 gauge with bituminous coating or approved equal (perforations turned down)." An earlier, now abandoned, drain field exists immediately west of the existing field. It was somewhat larger but otherwise similar to the existing field.

The septic tank is a 30-ft by 13-ft by 11-ft deep concrete box buried to a depth that places its upper surface at ground level. Three 3-ft entry openings exist on the top, each protected by a wooden cover. The tank is fed by an 8-in. vitrified tile pipe. A similar pipe connects the septic tank with a 5-ft by 4-ft by 9-ft deep concrete diversion box, and then to a second 7-ft by 5-ft by 9-ft deep concrete diversion box, before entering the drain field. Each diversion box is buried to a depth that places its upper surface at ground level and is provided with a manhole for personnel entry.

The drain field consists of five 135-ft runs of perforated 8-in. pipes laid 20 ft apart. It lies in a gravel bed that extends 2 ft below the drain pipe. The excavation is backfilled to a depth of 2-1/2 ft above the drain pipe, forming a surface that is 3 ft below original grade. The drain field is, therefore, identifiable as a large rectangular recess in the otherwise flat field west of the U Plant. It is protected by a wooden barricade and warning signs (site inspection; BHI 1994; Hanford drawings H-2-02590; H-2-05154; H-2-44511, Sheets 68 and 69; M-2904-W, Sheet 19),

No radionuclides or hazardous chemicals have been associated with this waste unit. Rate of sanitary waste and sewage generation is reported as 12.2 m^3/day (BHI 1994).

9.27 2607-W-7 SEPTIC TANK AND DRAIN FIELD

The 2607-W5 Septic Tank and Drain Field are located about 250 ft north of the northeast corner of the 221-U Canyon Building at Hanford coordinates N37825 W74050. Operating since 1954, this active waste site has received sanitary wastewater and sewage from the 221-U Canyon Building.

Little else is known about this waste unit. It may be located on Hanford drawings M-2904-W, Sheet 19; H-2-40774, but no further detail or history has been identified. Both drawings show the location of the septic tank, but neither shows the location of the drain field. Hanford drawing M-2904-W refers to a drain field, or irrigation field, with the following citation:

> "Note: Irrigation field to be laid out by field in accordance with specification #1909."

No radionuclides or hazardous chemicals have been associated with this waste unit. Rate of sanitary waste and sewage generation is reported as 1.02 m^3/day (BHI 1994).

9.28 276-U SOLVENT FACILITY

The 276-U Solvent Facility was omitted from the 200-UP-2 Operable Unit list of waste units but is described here in anticipation of its eventual inclusion.

The Solvent Facility is described by Crusselle and Romano (1982) as follows:

> "276-U solvent handling facility is an above ground concrete basin, 66'X54'X8' with 5' below grade. It is physically attached to the south end wall of 221-U."
>
> "The basin contains three tanks and three vacant concrete tank pads. Tank-380 is 17' in diameter and 17-1/2' high made of carbon steel with a 29,000 gal capacity. Tank-381 is 8' in diameter and 17-1/2' high made of black iron with a 6,000 gal capacity. Tank-388 is 6' in diameter and 14-1/2' high made of black iron with a 2,500 gal capacity."
>
> "There are stairs, platforms, catwalks, piping and utilities for service at the tank tops."

Tank-388 is the tank that was cleaned in 1957 and its waste placed in the 216-U-15 Trench (see 216-U-15 Trench).

Crusselle and Romano (1982) report the following history for this waste site:

> "276-U was built for TBP (tri-butyl phosphate) and diluent storage, and for makeup and treatment of the organic solution used in 221-U. Three of six tanks have been removed and only tank pads remain. Piping above the vacant tank pads is cut and covered with tape and plastic. The remaining tanks are unused and this facility is considered retired."

The 276-U Solvent Facility is located at Hanford coordinates N38500 W73400 (BHI 1994).

No radionuclide or hazardous chemical inventories are available, but the facility is known to be contaminated. DOE-RL (1988) and DOE-RL (1991b) reports that it contains:

> "... surface contamination on tanks and concrete; amounts have not been determined. There is 20,000 counts per minute smearable beta/gamma fixed by paint, less than 500 counts per minute direct and smearable alpha, and 300 mRem per hour penetrating."

9.29 BURIAL GROUND AND BURNING GROUND

Underground radioactive contamination is reported to exist at a burial ground and burning ground near the U Plant, neither of which are included in the 200-UP-2 list of waste sites.

A burial ground is located immediately northeast of the intersection of 16th Street and Beloit Avenue at approximate Hanford coordinates N72500 W38000. It is barricaded with metal posts and chain and is marked with "Underground Radioactive Material" signs. Its contents are unknown (site visit; Hanford drawings H-2-44510, Sheet 3; H-2-77174; H-2-34762).

A burning ground is located immediately east of Beloit Avenue and immediately south of the ash disposal pit at approximate Hanford coordinates N39500 W72500. Only one drawing shows this waste site (Hanford drawing H-2-34762, Sheet 1).

Baldridge (1959) reports contamination at a site that could be either of the above waste sites. He reports:

> "Contamination was discovered in the spring of 1950 in the old burning ground which is located approximately 1,500 ft east of the "U" facility. An area of 150 ft^2 of ground was observed to be contaminated to a maximum dose rate of 45 rads/hour at 2-in. The area was subsequently covered with about 10 ft of clean earth and is posted with "Underground Contamination" signs."

This author determined by a site visit that a barricade and warning signs exist at the burial ground, but none at the burn ground. An interview was conducted with 200 West Area personnel who remember that contamination was located at the "old burning grounds" and was cleaned up around 1970 and the area released as a radiation zone. They recall that contaminated special work permit (SWP) clothing were found to have been disposed of at the site. These and an unspecified amount of soil and debris were removed and transported to another burial ground for disposal (Mickulecky and Stark 1991).

No other data has been located that references these waste sites.

10.0 OPERABLE UNIT 200-UP-3, TANK FARM

Barron (1979) states:

> "Since 1944, radioactive wastes from the processing of irradiated uranium have been stored as alkaline slurries in underground tanks. Between 1943 and 1977, 156 tanks were constructed for use, ranging in capacity from 55,000 gal to 1 million gal. These tanks are grouped in 15 tank farms located in the 200 East and 200 West Areas. The oldest tank farms - 241-B, C, T, and U - were constructed in 1943-44 concurrently with the Bismuth Phosphate Plants. The first waste was routed to tank storage in December 1944. Additional tanks in separate tank farm locations have been constructed, incorporating various design changes and reflecting various philosophy changes to accommodate the wastes."
>
> "The basic containment employed in the design of the tanks in the first twelve farms was the provision for a reinforced concrete shell with a carbon steel liner. During the history of the tank farms, leaks have been confirmed in 20 of the existing 169 tanks (at time of writing of RHO-MA-230). Leaks have occurred in nine tanks storing aging wastes and in eleven tanks holding non-aging wastes. An improved tank design to provide more protection against possible release of radioactive materials to the environment was developed to have a double steel liner within a concrete shell, thereby providing an extra barrier against release of radioactive liquids, plus recovery facilities for any liquid which might collect in the annular space between the liners."
>
> "Four basic chemical processing operations were the source of radioactive waste solutions transferred to underground storage tanks since start-up of the Hanford site. These were the Bismuth Phosphate Process, TriButyl Phosphate (TBP) Process, the Redox Process, and the Purex Process."
>
> "Three of these were chemical programs for recovery of plutonium from irradiated reactor fuels. The TBP process was designed for recovery of uranium metal waste generated by the Bismuth Phosphate Process. In all cases, the aqueous wastes were made alkaline for storage in underground steel tanks."

Operable Unit 200-UP-3 consists of the 241-U Tank Farm that received primarily TBP process high-level liquid wastes generated by the U Plant Uranium Recovery Program. It includes 31 waste sites and 7 UPRs. Sixteen of these waste sites are underground tanks (the 241-U Tank Farm). Also included are diversion boxes, receiving vault, catch tanks, and a septic tank. Four of the seven UPRs concern leaking tanks.

A general description of the tank farm is provided by Geer (1991) who prepared a descriptive notice for tank farm visitors that is posted on the tank farm security fence.

> "U Farm. Tank farm facilities are scattered through the 200 East and West areas of the Hanford site. The SST tank farms were built close to the plants that they served (< .5 mi.). The treatment facilities were also close to their related plants."

"All SST tank farms are inactive, meaning that no tanks receive waste from any operating plant. Ongoing stabilization, isolation and surveillance require routine personnel access on a limited scale. Leaks are detected by drywells and area radiation monitoring."

"Each tank farm is isolated from active facilities as a unit, along with its directly associated diversion boxes. The tanks themselves remain undisturbed. Process pipelines are isolated at the nearest diversion box, and utility lines and pipes are disconnected as near as possible to main supplies. In tank equipment in risers is abandoned in place where possible, but certain equipment that is an obstruction to surveillance or that cannot be sealed is removed. Basic surveillance equipment (surface level sensor, thermocouple) is retained, and an observation port is cleared on each tank for in-tank photographs. A breather filter is installed on each tank that does not normally use an active ventilation system. Unneeded instrument and electrical enclosures are removed. All aboveground tank risers are sealed. Pits and miscellaneous equipment are covered with polyurethane foam and vapor barrier to provide the primary seal."

"U Farm is one of the first four tank farms, constructed in 1943-44. Twelve of the tanks are 75 ft in diameter with capacities of 530,000 gal and four are 20 ft in diameter with capacities of 55,000 gal. The 75-ft-diameter tanks are arranged in four cascades of three tanks each; feed was pumped into the high tank and overflowed into the low tank. The tanks in each cascade are separated by one vertical foot. The 20-ft-diameter tanks were also used to settle waste, with the supernatant overflowing into a crib (soil disposal)."

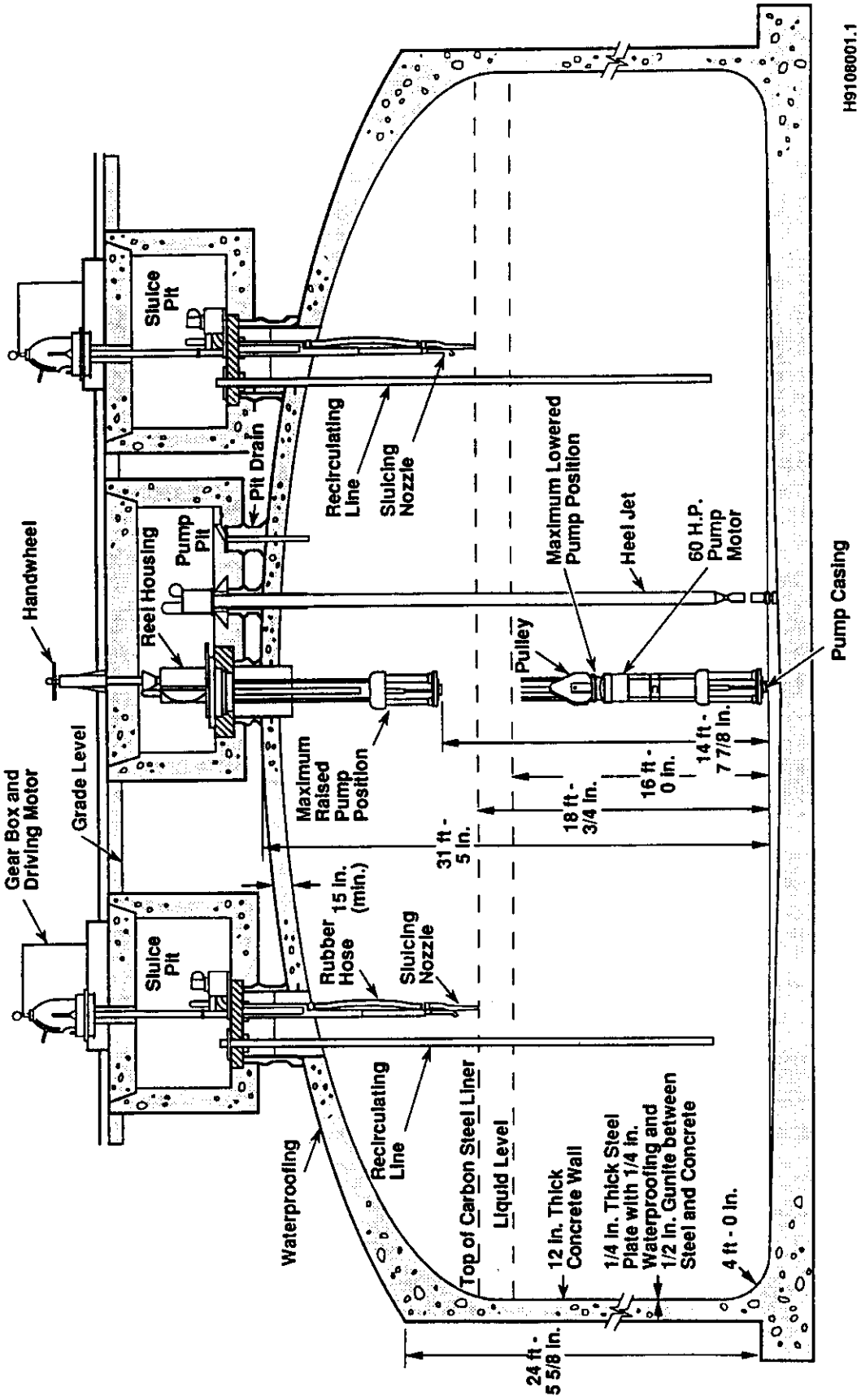
"Tanks 241-U-101 through 109 received Bismuth phosphate metal waste from T Plant and were subsequently sluiced back to the tri-butyl phosphate recovery process in U Plant. Waste was received from various storage tanks for processing in the 242-T Evaporator. The last cascade (241-U-110 through 112) received first cycle decontamination waste which was self-evaporated. All three tanks were then used for REDOX waste storage and evaporator feed."

"Eight U Farm tanks are currently classified interim stabilized (U-101, 104, 110, 112, 202, 203, and 204, while the rest are listed as inactive-sound, partially interim isolated. The stabilized tanks, with the exception of Tank 110, are interim isolated. Tank U-110 does not meet present interim stabilization criteria and it is planned that additional liquid will be pumped from it."

"U-101 received a variety of solid waste items between the period of May 1969 to June 1971. These included fuel elements, shroud tubes and Samarium balls. The total fissile material content of the waste was 1530 grams of 4.5% enrichment uranium and 6 grams of Pu."

Figure 10-1 illustrates the 530,000 single-shell high-level waste tank common to the early Hanford Tank Farms and to the 241-U Tank Farm in particular.

Figure 10-1. 530,000 Gallon Single-Shell Waste Tank (Typical).



The above commentary refers to supernatant overflowing from the 20-ft tanks into a crib. Austin (1991), 241-U Tank Farm employees, in a August 1991 conversation, suggests that she remembers hearing about such a crib; that it was located in the approximate area of the 216-U-13 Trenches; that it was wooden and received overflow from the 241-U-201 through 241-U-204 tanks; and that it collapsed and was backfilled many years ago. Aside from these references, this author has been unable to discover any evidence of the existence of such a crib.

Another general description of the 241-U Tank Farm is provided by the WIDS background hard files as follows:

> "The 241-U Tank Farm contains 16 single-shell tanks, 12 with the capacity of 500,000 gal each and 4 smaller tanks with the capacity of 55,000 gal each. The Tanks are arranged in groups of three for usage of the settling cascade concept in which waste solutions were passed in series through three tanks. Cooling and precipitation occurred in each tank causing the bulk of the radionuclides to collect in the tank's bottoms. To prevent the heating-up of the wastes, air cooled reflux condensers were installed which return the condensate to the tank and vent the noncondensables to the atmosphere. There are several dry wells within the tank farm used to monitor the soil for radioactivity, thus serving as a leak detection system. The tank farm was started in 1946 (constructed in 1943-1944)."

Hanford drawing H-2-38990 provides data on the soils and geology beneath the 241-U Tank Farm.

All 241-U tanks were connected to the Computer Automated Surveillance System (CASS) that provides centralized monitoring of waste tank fluid levels and temperatures. The main CASS signal lines from 241-U were accidently severed in 1985 and never repaired and the tank farm is no longer monitored by CASS.

10.1 NATURE OF WASTES STORED IN TANKS

The first liquid wastes to flow to the U Tank Farm were bismuth phosphate (BP) high-level wastes and supernate from T Plant. This waste, high in uranium content and radioactive fission products, was discharged from T Plant in a slightly alkaline metastable waste solution (pH of about 10.5), and was composed of the following ingredients in the approximate proportions indicated:

Constituent	lb/short ton U
UNH	4,220
HNO_3	170 to 210
H_2SO_4	700 to 810
H_3PO_4	730 to 1,110
$NaNO_3$	130 to 210
NaCH	1,560 to 1,680
Na_2CO_3	3,960 to 4,060
H_2O	27,000 to 28,000

"Pounds per short ton of Uranium" refers to the quantity of waste constituent deriving from each short ton of irradiated uranium fuel elements processed by T Plant.

When stored in underground tanks, the solids, mainly complex sodium uranyl phosphocarbonates, separate and settle out, forming a sludge. About 75% of the BP process residual uranium was contained in this sludge and the remaining 25% in the supernatant liquor. The feed to the 221-U Uranium Recovery Plant comprised both sludge and supernate (GE 1951).

The fission product radioactivity associated with the BP process waste is a function of the irradiation history of the parent fuel elements and of the time elapsed since irradiation. Ranges of radioactivity are estimated in GE (1951), but remain partially classified and may not be reported here. In any case, all of these wastes were presumably pumped to U Plant for uranium recovery (TBP process) and replaced by other wastes as described below.

The U Plant TBP process generated two high-level liquid waste streams that were ultimately transferred back to the 241-U Tank Farm for long term storage. These were the aqueous waste streams from the RA and RO column (RAW and ROW). These two streams were combined and neutralized with NaOH before concentration. Neutralization was necessary to minimize corrosion in the waste evaporator and in the underground storage tanks. The neutralized waste was concentrated by evaporation and returned to the underground waste storage tanks that originally contained the BP process wastes. The volume of TBP waste returned was approximately equal to the original BP waste volume.

This TBP process waste was composed of one of the two following lists of ingredients and in the approximate proportions indicated:

Constituent	Molarity	Gram/Liter
Density		1,398
UNH	.0026	1.30
SO_4	.346	33.2
PO_4	.156	14.8
HPO_4	.094	9.0
NO_3	6.19	384
CL	.022	0.78
OH	.072	1.22
Na	7.56	174
Fe	.024	1.54

pH	>9.5
% Feed U	<1.0
% Feed Pu	>99.6
Beta Ci/gal	4.1
Gamma Ci/gal	1.4

Flow	104
Freezing Point	28 to 30 °C

OR

Constituent	Molarity	Gram/Liter
Density		1,398
UNH	.0026	1.30
SO_4	.346	33.2
PO_3	.25	28.7
NO_3	6.18	383
CL	.022	0.78
H	.094	0.094
Na	7.57	168
$Fe(OH)_3$	0.024	2.56

pH	>9.5
% Feed U	<1.0
% Feed Pu	>99.6
Beta Ci/gal	4.1
Gamma Ci/gal	1.4
Flow	104
Freezing Point	28 to 30 °C

10.2 TANK FARM CHARACTERIZATION

To date, we have discovered no evidence of groundwater or waste plume characterization of the 241-U Tank Farm. Geology of the 241-U Tank Farm is characterized by Fecht and Price (1976). Groundwater monitoring has been accomplished on a regular basis and is described in WHC (1988), WHC (1989), and DOE-RL (1991a). The latter document describes RCRA groundwater monitoring projects and notes that monitoring of new wells placed adjacent to the 241-U Tank Farm will begin in 1991.

The following waste site descriptions are of the 12 large and 4 small single-shell waste tanks in the 241-U Tank Farm. Related diversion boxes and catch tanks are also described.

10.3 241-U-101 SINGLE-SHELL TANK

The 241-U-101 Single-Shell Tank is located in the 241-U Tank Farm that is immediately west of Camden Avenue and north of 16th Street in Hanford's 200 West Area.

241-U-101 is the northeastern most tank in the tank farm and is the first tank in a three tank cascade comprised of 241-U-101, 241-U-102, and 241-U-103. Wastes flowed first into 241-U-101, filling it to a depth of about 17 ft; then overflowed into 214-U-102; and from there into 241-U-103.

It is classified as an inactive mixed waste site that operated from 1946 until 1959 to receive high-level liquid wastes from T Plant, U Plant, and Redox. It is a "confirmed leaker." From 1969 to 1971, it also received a variety of solid wastes including experimental fuel elements, shroud tubes and Samarium balls ("poison" ceramic balls). These included 1,530 g of 4.5% enrichment uranium, 6 g of plutonium, 180 kCi of Cobalt-60, and 130 Ci of mixed fission products, plus 60 cobalt slugs with 70 kCi of Cobalt-60 (BHI 1994).

The tank has a capacity of 533,000 gal and has a carbon steel liner within a concrete shell. It is entirely below grade, has a dished bottom and had an operating depth of 17 ft (Anderson and Mudd 1979).

Hanford drawings (SK-2-18625; H-2-37381, Sheet 3; H-2-72742; H-2-73145) describe the tank in detail. It is 75 ft in diameter and is about 32 ft high. Its entire structure is underground with its upper surface about 9 ft below grade. It is equipped with radiation monitoring wells, temperature sensors, and liquid level gauges. A 60 horsepower pump may be raised and lowered in the tank. A heel jet, two sluicing nozzles, and two recirculating lines also reside in the tank. Hanford drawing H-2-73145 describes the manner in which the tank was isolated when removed from service (i.e., lines cut and capped).

The WIDS data base (BHI 1994) describes its liquid contents as "bismuth phosphate metal waste and supernatant containing bismuth phosphate metal waste and REDOX high-level waste from -U and -SX tank farms."

30,000 gal of BP metal waste and supernatant containing high-level waste are known to have leaked from the tank in 1959. The tank was removed from service at that time and later used to store solid wastes mentioned above. The tank was pumped out and liquid level measurements were discontinued, but resumed in 1974 when in-tank photographs revealed residual liquid in the tank. Two additional dry wells were drilled in 1974 to 1975 for monitoring purposes (UPR-200-W-154; DOE-RL 1991b)

The Tank Farm Surveillance Report for January 1991 shows that this tank contains about 5 in. of liquid waste; about 25,000 gal (Hanlon 1991).

10.4 241-U-102 SINGLE-SHELL TANK

The 241-U-102 Single-Shell Tank is located in the 241-U Tank Farm that is immediately west of Camden Avenue and north of 16th Street in Hanford's 200 West Area.

241-U-102 is the middle tank in a three tank cascade comprised of 241-U-101, 241-U-102, and 241-U-103. Wastes flowed first into 241-U-101; then overflowed into 214-U-102; and from there into 241-U-103.

It is classified as an inactive mixed waste site that operated from 1946 until 1979 to receive high-level liquid wastes from T Plant, U Plant, and Redox.

The tank has a capacity of 533,000 gal and has a carbon steel liner within a concrete shell. It is entirely below grade, has a dished bottom, and had an operating depth of 17 ft (Anderson and Mudd 1979).

Hanford drawings (SK-2-18625; H-2-37381, Sheet 3; H-2-72742; H-2-73149) describe the tank in detail. It is 75 ft in diameter and is about 32 ft high. Its entire structure is underground with its upper surface about 9 ft below grade. It is equipped with radiation monitoring wells, temperature sensors, and liquid level gauges. A 60 horsepower pump may be raised and lowered within the tank. A heel jet, two sluicing nozzles, and two recirculating lines also reside in the tank. Hanford drawing H-2-73149 describes the manner in which the tank was isolated when removed from service (i.e., lines cut and capped).

The WIDS data base (BHI 1994) describes its liquid contents as "bismuth phosphate metal waste; 242-T Evaporator waste; $HNO_4/KMnO_4$ solution; and supernatant containing REDOX high-level waste, evaporator bottoms, bismuth phosphate metal waste, and uncomplexed waste from 241-C, -SX, -SY, -TX, and -U tanks."

The Tank Farm Surveillance Report for January 1991 shows that this tank contains about 132 in. of waste; about 374,000 gal (Hanlon 1991).

10.5 241-U-103 SINGLE-SHELL TANK

The 241-U-103 Single-Shell Tank is located in the 241-U Tank Farm that is immediately west of Camden Avenue and north of 16th Street in Hanford's 200 West Area.

241-U-103 is the final tank in a three tank cascade comprised of 241-U-101, 241-U-102, and 241-U-103. Wastes flowed first into 241-U-101; then overflowed into 214-U-102; and from there into 241-U-103.

It is classified as an inactive mixed waste site that operated from 1947 until 1978 to receive high-level liquid wastes from T Plant, U Plant, and Redox.

The tank has a capacity of 533,000 gal and has a carbon steel liner within a concrete shell. It is entirely below grade, has a dished bottom, and had an operating depth of 17 ft (Anderson and Mudd 1979).

Hanford drawings (SK-2-18625; H-2-37381, Sheet 3; H-2-72742; H-2-73151) describe the tank in detail. It is 75 ft in diameter and is about 32 ft high. Its entire structure is underground with its upper surface about 9 ft below grade. It is equipped with radiation monitoring wells, temperature sensors, and liquid level gauges. A 60 horsepower pump may be raised and lowered in the tank. A heel jet, two sluicing nozzles, and two recirculating lines also reside in the tank. Hanford drawing H-2-73151 describes the manner in which the tank was isolated when removed from service (i.e., lines cut and capped).

The WIDS data base (BHI 1994) describes its liquid contents as "bismuth phosphate metal waste; 242-T Evaporator waste; $HNO_4/KMnO_4$ solution; and supernatant containing REDOX high-level waste and ion exchange waste, coating waste, evaporator bottoms, and PNL waste from 241-SX, -SY, -TX, and -U tanks."

The Tank Farm Surveillance Report for January 1991 shows that this tank contains about 166 in. of waste; about 468,000 gal. It has a potential for hydrogen or flammable gas generation. In 1989, this unit had a maximum temperature of 87 °F (Hanlon 1991).

A UPR occurred at this site in 1971 when a waste line was inadvertently cut and contaminated liquid waste was spilled onto the surface (UPR-200-W-128).

10.6 241-U-104 SINGLE-SHELL TANK

The 241-U-104 Single-Shell Tank is located in the 241-U Tank Farm that is immediately west of Camden Avenue and north of 16th Street in Hanford's 200 West Area.

241-U-104 is the first tank in a three tank cascade comprised of 241-U-104, 241-U-105, and 241-U-106. Wastes flowed first into 241-U-104, filling it to a depth of about 17 ft; then overflowed into 214-U-105; and from there into 241-U-106.

It is classified as an inactive mixed waste site that operated from 1947 until 1956 to receive high-level liquid wastes from T Plant, U Plant, and Redox. It is a "confirmed leaker." The unit was removed from service in 1956 when a rupture in the tank bottom was detected (UPR-200-W-155; BHI 1994).

The tank has a capacity of 533,000 gal and has a carbon steel liner within a concrete shell. It is entirely below grade, has a dished bottom, and had an operating depth of 17 ft (Anderson and Mudd 1979).

Hanford drawings (SK-2-18625; H-2-37381, Sheet 3; H-2-72742; H-2-73146) describe the tank in detail. It is 75 ft in diameter and is about 32 ft high. Its entire structure is underground with its upper surface about 9 ft below grade. It is equipped with radiation monitoring wells, temperature sensors, and liquid level gauges. A 60 horsepower pump may be raised and lowered in the tank. A heel jet, two sluicing nozzles, and two recirculating lines also reside in the tank. Hanford drawing H-2-73146 describes the manner in which the tank was isolated when removed from service (i.e., lines cut and capped).

The WIDS data base (BHI 1994) describes its liquid contents as "bismuth phosphate metal waste." Diamataceous earth was added in 1969 (Hanlon 1991).

The Tank Farm Surveillance Report for January 1991 shows that this tank contains about 40 in. of liquid waste; about 122,000 gal (Hanlon 1991).

10.7 241-U-105 SINGLE-SHELL TANK

The 241-U-105 Single-Shell Tank is located in the 241-U Tank Farm that is immediately west of Camden Avenue and north of 16th Street in Hanford's 200 West Area.

241-U-105 is the middle tank in a three tank cascade comprised of 241-U-104, 241-U-105, and 241-U-106. Wastes flowed first into 241-U-104; then overflowed into 214-U-105; and from there into 241-U-106.

It is classified as an inactive mixed waste site that operated from 1947 until 1978 to receive high-level liquid wastes from T Plant, U Plant, and Redox.

The tank has a capacity of 533,000 gal and has a carbon steel liner within a concrete shell. It is entirely below grade, has a dished bottom, and had an operating depth of 17 ft (Anderson and Mudd 1979).

Hanford drawings (SK-2-18625; H-2-37381, Sheet 3; H-2-72742; H-2-73153) describe the tank in detail. It is 75 ft in diameter and is about 32 ft high. Its entire structure is underground with its upper surface about 9 ft below grade. It is equipped with radiation monitoring wells, temperature sensors, and liquid level gauges. A 60 horsepower pump may be raised and lowered in the tank. A heel jet, two sluicing nozzles, and two recirculating lines also reside in the tank. Hanford drawing H-2-73153 describes the manner in which the tank was isolated when removed from service (i.e., lines cut and capped).

The WIDS data base (BHI 1994) describes its liquid contents as "bismuth phosphate metal waste; 242-T Evaporator waste, and supernatant containing coating waste from 241-U Tank."

The Tank Farm Surveillance Report for January 1991 shows that this tank contains about 148 in. of liquid waste; about 418,000 gal. It has the potential for hydrogen or flammable gas generation. In 1989, this unit had a maximum temperature of 89 °F (Hanlon 1991).

10.8 241-U-106 SINGLE-SHELL TANK

The 241-U-106 Single-Shell Tank is located in the 241-U Tank Farm that is immediately west of Camden Avenue and north of 16th Street in Hanford's 200 West Area.

241-U-106 is the final tank in a three tank cascade comprised of 241-U-104, 241-U-105, and 241-U-106. Wastes flowed first into 241-U-104; then overflowed into 214-U-105; and from there into 241-U-106.

It is classified as an inactive mixed waste site that operated from 1948 until 1977 to receive high-level liquid wastes from T Plant, U Plant, and Redox.

The tank has a capacity of 533,000 gal and has a carbon steel liner within a concrete shell. It is entirely below grade, has a dished bottom, and had an operating depth of 17 ft (Anderson and Mudd 1979).

Hanford drawings (SK-2-18625; H-2-37381, Sheet 3; H-2-72742; H-2-73154) describe the tank in detail. It is 75 ft in diameter and is about 32 ft high. Its entire structure is underground with its upper surface about 9 ft below grade. It is equipped with radiation monitoring wells, temperature sensors, and liquid level gauges. A 60 horsepower pump may be raised and lowered in the tank. A heel jet, two sluicing nozzles, and two recirculating lines also reside in the tank. Hanford drawing H-2-73154 describes the manner in which the tank was isolated when removed from service (i.e., lines cut and capped).

The WIDS data base (BHI 1994) describes its liquid contents as "bismuth phosphate metal waste, REDOX high-level waste, PUREX low-level waste, B Plant low-level waste, and evaporator bottoms

from 241-C and-U tanks." It contains potentially high concentrations of organic salts. In 1991, this unit had a maximum temperature of 82 °F (Hanlon 1991).

The Tank Farm Surveillance Report for January 1991 shows that this tank contains about 78 in. of waste; about 226,000 gal.

A sudden reduction in fluid level in 1977 caused alarm that this tank may have begun to leak. Subsequent studies described in Schultz (1981) determined that no leaking had occurred.

10.9 241-U-107 SINGLE-SHELL TANK

The 241-U-107 Single-Shell Tank is located in the 241-U Tank Farm that is immediately west of Camden Avenue and north of 16th Street in Hanford's 200 West Area.

241-U-107 is the first tank in a three tank cascade comprised of 241-U-107, 241-U-108, and 241-U-109. Wastes flowed first into 241-U-107, filling it to a depth of about 17 ft; then overflowed into 214-U-108; and from there into 241-U-109.

It is classified as an inactive mixed waste site that operated from 1948 until 1980 to receive high-level liquid wastes from T Plant, U Plant, and Redox.

The tank has a capacity of 533,000 gal and has a carbon steel liner within a concrete shell. It is entirely below grade, has a dished bottom, and had an operating depth of 17 ft (Anderson and Mudd 1979).

Hanford drawings (SK-2-18625; H-2-37381, Sheet 3; H-2-72742; H-2-73155) describe the tank in detail. It is 75 ft in diameter and is about 32 ft high. Its entire structure is underground with its upper surface about 9 ft below grade. It is equipped with radiation monitoring wells, temperature sensors, and liquid level gauges. A 60 horsepower pump may be raised and lowered in the tank. A heel jet, two sluicing nozzles, and two recirculating lines also reside in the tank. Hanford drawing H-2-73155 describes the manner in which the tank was isolated when removed from service (i.e., lines cut and capped).

The WIDS data base (BHI 1994) describes its liquid contents as "bismuth phosphate metal waste; HNO4/KMnO4 solution; N Reactor waste, PNL Waste; decontamination waste; lab waste; and supernatant containing decontamination waste, PNL waste, coating waste, double-shell slurry feed, REDOX high-level waste, N Reactor waste, evaporator bottoms, and complexed and noncomplexed waste from 241-S, -SX, -T, -U, and -SY tanks."

The Tank Farm Surveillance Report for January 1991 shows that this tank contains about 143 in. of waste; about 406,000 gal. It contains potentially high concentrations of organic salts. In 1991, this unit had a maximum temperature of 79 °F (Hanlon 1991).

Three of four dry wells associated with this tank have had low-level activity at approximately the 50-ft level (Stalos and Walker 1977).

10.10 241-U-108 SINGLE-SHELL TANK

The 241-U-108 Single-Shell Tank is located in the 241-U Tank Farm that is immediately west of Camden Avenue and north of 16th Street in Hanford's 200 West Area.

241-U-108 is the middle tank in a three tank cascade comprised of 241-U-107, 241-U-108, and 241-U-109. Wastes flowed first into 241-U-107; then overflowed into 214-U-108; and from there into 241-U-109.

It is classified as an inactive mixed waste site that operated from 1949 until 1979 to receive high-level liquid wastes from T Plant, U Plant, and Redox.

The tank has a capacity of 533,000 gal and has a carbon steel liner within a concrete shell. It is entirely below grade, has a dished bottom, and had an operating depth of 17 ft (Anderson and Mudd 1979).

Hanford drawings (SK-2-18625; H-2-37381, Sheet 3; H-2-72742; H-2-73156) describe the tank in detail. It is 75 ft in diameter and is about 32 ft high. Its entire structure is underground with its upper surface about 9 ft below grade. It is equipped with radiation monitoring wells, temperature sensors, and liquid level gauges. A 60 horsepower pump may be raised and lowered in the tank. A heel jet, two sluicing nozzles, and two recirculating lines also reside in the tank. Hanford drawing H-2-73156 describes the manner in which the tank was isolated when removed from service (i.e., lines cut and capped).

The WIDS data base (BHI 1994) describes its liquid contents as "bismuth phosphate metal waste; REDOX coating waste; and supernatant containing coating waste, N Reactor waste, lab waste, PNL waste, and evaporator bottoms from 241-S and -U tanks."

The Tank Farm Surveillance Report for January 1991 shows that this tank contains about 166 in. of waste; about 468,000 gal. It has the potential for hydrogen or flammable gas generation. In 1989, this unit had a maximum temperature of 87 °F (Hanlon 1991).

10.11 241-U-109 SINGLE-SHELL TANK

The 241-U-109 Single-Shell Tank is located in the 241-U Tank Farm that is immediately west of Camden Avenue and north of 16th Street in Hanford's 200 West Area.

241-U-109 is the final tank in a three tank cascade comprised of 241-U-107, 241-U-108, and 241-U-109. Wastes flowed first into 241-U-107; then overflowed into 214-U-108; and from there into 241-U-109.

It is classified as an inactive mixed waste site that operated from 1949 until 1978 to receive high-level liquid wastes from T Plant, U Plant, and Redox.

The tank has a capacity of 533,000 gal and has a carbon steel liner within a concrete shell. It is entirely below grade, has a dished bottom, and had an operating depth of 17 ft (Anderson and Mudd 1979).

Hanford drawings (SK-2-18625; H-2-37381, Sheet 3; H-2-72742; H-2-73157) describe the tank in detail. It is 75 ft in diameter and is about 32 ft high. Its entire structure is underground with its upper surface about 9 ft below grade. It is equipped with radiation monitoring wells, temperature sensors, and liquid level gauges. A 60 horsepower pump may be raised and lowered in the tank. A heel jet, two sluicing nozzles, and two recirculating lines also reside in the tank. Hanford drawing H-2-73157 describes the manner in which the tank was isolated when removed from service (i.e., lines cut and capped).

The WIDS data base (BHI 1994) describes its liquid contents as "bismuth phosphate metal waste and supernatant containing REDOX high-level waste, metal waste, coating waste, and evaporator bottoms from 241-TX and -U tanks."

The Tank Farm Surveillance Report for January 1991 shows that this tank contains about 164 in. of waste; about 463,000 gal. It has the potential for hydrogen or flammable gas generation. In 1989, this unit had a maximum temperature of 85 °F (Hanlon 1991).

10.12 241-U-110 SINGLE-SHELL TANK

The 241-U-110 Single-Shell Tank is located in the 241-U Tank Farm that is immediately west of Camden Avenue and north of 16th Street in Hanford's 200 West Area.

241-U-110 is the first tank in a three tank cascade comprised of 241-U-110, 241-U-111, and 241-U-112. Wastes flowed first into 241-U-110, filling it to a depth of about 17 ft; then overflowed into 214-U-111; and from there into 241-U-112.

It is classified as an inactive mixed waste site that operated from 1946 until 1975 to receive high-level liquid wastes from T Plant, U Plant, and Redox. This tank is a "confirmed leaker" (BHI 1994).

The tank has a capacity of 533,000 gal and has a carbon steel liner within a concrete shell. It is entirely below grade, has a dished bottom, and had an operating depth of 17 ft (Anderson and Mudd 1979).

Hanford drawings (SK-2-18625; H-2-37381, Sheet 3; H-2-72742; H-2-73147) describe the tank in detail. It is 75 ft in diameter and is about 32 ft high. Its entire structure is underground with its upper surface about 9 ft below grade. It is equipped with radiation monitoring wells, temperature sensors, and liquid level gauges. A 60 horsepower pump may be raised and lowered in the tank. A heel jet, two sluicing nozzles, and two recirculating lines also reside in the tank. Hanford drawing H-2-73147 describes the manner in which the tank was isolated when removed from service (i.e., lines cut and capped).

The WIDS data base (BHI 1994) describes its liquid contents as "bismuth phosphate metal waste; REDOX coating and high-level waste; lab waste; and PNL waste."

The Tank Farm Surveillance Report for January 1991 shows that this tank contains about 63 in. of waste; about 186,000 gal (Hanlon 1991).

8,100 gal of BP first-cycle waste and Redox coating and high-level wastes are thought to have leaked to soil in 1975. The tank was removed from service and pumped to a heel. A saltwell was installed

to remove the residual heel and interstitial liquid after rapid snow melt in a pump pit intruded into the tank (DOE-RL 1991b; Stalos and Walker 1977; UPR-200-W-156).

10.13 241-U-111 SINGLE-SHELL TANK

The 241-U-108 Single-Shell Tank is located in the 241-U Tank Farm that is immediately west of Camden Avenue and north of 16th Street in Hanford's 200 West Area.

241-U-111 is the middle tank in a three tank cascade comprised of 241-U-110, 241-U-111, and 241-U-112. Wastes flowed first into 241-U-110 and then overflowed into 214-U-111; and from there into 241-U-112.

It is classified as an inactive mixed waste site that operated from 1947 until 1980 to receive high level liquid wastes from T Plant, U Plant, and Redox.

The tank has a capacity of 533,000 gal and has a carbon steel liner within a concrete shell. It is entirely below grade, has a dished bottom, and had an operating depth of 17 ft (Anderson and Mudd 1979).

Hanford drawings (SK-2-18625; H-2-37381, Sheet 3; H-2-72742; H-2-73158) describe the tank in detail. It is 75 ft in diameter and is about 32 ft high. Its entire structure is underground with its upper surface about 9 ft below grade. It is equipped with radiation monitoring wells, temperature sensors, and liquid level gauges. A 60 horsepower pump may be raised and lowered in the tank. A heel jet, two sluicing nozzles, and two recirculating lines also reside in the tank. Hanford drawing H-2-73158 describes the manner in which the tank was isolated when removed from service (i.e., lines cut and capped).

The WIDS data base (BHI 1994) describes its liquid contents as "bismuth phosphate first cycle waste; $HNO_4/KMnO_4$; and supernatant containing REDOX high-level waste, N Reactor waste, PNL waste, decontamination waste, evaporator bottoms, partial neutralization feed, and complexed waste from 241-SY, -TY, and -U tanks."

The Tank Farm Surveillance Report for January 1991 shows that this tank contains about 115 in. of waste; about 329,000 gal (Hanlon 1991).

10.14 241-U-112 SINGLE-SHELL TANK

The 241-U-112 Single-Shell Tank is located in the 241-U Tank Farm that is immediately west of Camden Avenue and north of 16th Street in Hanford's 200 West Area.

241-U-112 is the final tank in a three tank cascade comprised of 241-U-110, 241-U-111, and 241-U-112. Wastes flowed first into 241-U-110; then overflowed into 214-U-111; and from there into 241-U-112.

It is classified as an inactive mixed waste site that operated from 1949 until 1978 to receive high-level liquid wastes from T Plant, U Plant, and Redox. It is a "confirmed leaker" (BHI 1994).

The tank has a capacity of 533,000 gal and has a carbon steel liner within a concrete shell. It is entirely below grade, has a dished bottom, and had an operating depth of 17 ft (Anderson and Mudd 1979).

Hanford drawings (SK-2-18625; H-2-37381, Sheet 3; H-2-72742; H-2-70125) describe the tank in detail. It is 75 ft in diameter and is about 32 ft high. Its entire structure is underground with its upper surface about 9 ft below grade. It is equipped with radiation monitoring wells, temperature sensors, and liquid level gauges. A 60 horsepower pump may be raised and lowered in the tank. Hanford drawing H-2-70125 describes the manner in which the tank was isolated when removed from service (i.e., lines cut and capped).

The WIDS data base (BHI 1994) describes its liquid contents as "bismuth phosphate first cycle waste and supernatant containing bismuth phosphate first cycle waste and REDOX high-level waste from 241-U tanks."

The Tank Farm Surveillance Report for January 1991 shows that this tank contains about 13 in. of waste; about 49,000 gal (Hanlon 1991).

500 gal of supernatant containing BP first-cycle and recycled waste were lost to soil though a tank leak in 1969. The tank was removed from service in 1970 and a saltwell system installed to remove tank contents (DOE-RL 1991b; UPR-200-W-157).

10.15 241-U-201, 241-U-202, 241-U-203, AND 241-U-204 SINGLE-SHELL TANKS

Tanks 241-U-201 through 241-U-204 are located in a north/south line along the western border of the 241-U Tank Farm. They are identical tanks constructed in 1956 to receive supernatant containing Redox high-level waste from the other 241-U tanks.

These 20-ft-diameter tanks are composed of a steel liner within a concrete shell. Each is 25 ft high and has a capacity of 55,000 gal. All are below grade with their bottoms about 37 ft below the surface. As with the other 241-U tanks, the connection with the CASS system has been severed and these tanks are no longer served by that automated monitoring system.

The tanks were pumped out when inactivated in 1977. Tanks 241-U-201 and 241-U-202 still have about 29 in. (5,000 gal) of waste in them; 4,000 gal of sludge; and 1,000 gal of supernatant liquid. Tanks 241-U-203 and 241-U-204 each have about 18 in. (3,000 gal) of waste; 1,000 gal of supernatant; and 2,000 gal of sludge.

The condensor towers have been removed and all surface level tank fixtures have been weather sealed with plasticized foam.

These tanks may be located on Hanford drawing H-2-44511, Sheets 62 and 70, and are described in detail on Hanford drawings HW-72742; SK-2-18625; H-2-73159 through H-2-73162.

See Chapter 10.0 (Austin 1991) for references to a crib that may have existed to receive overflow wastes from these tanks. This author has been unable to substantiate the existence of such a crib(s).

10.16 241-UR-151 DIVERSION BOX

The 241-UR-151 Diversion Box is an inactive waste unit located at the north end of the 241-U Tank Farm. This unit is the master diversion box for the tank farm. It is a large, 54-ft by 27-ft by 11-ft high, concrete box with a floor drain connected to the 244-UR Vault. It is buried to a depth that places the upper surface of its 3-ft thick lid a few inches above ground level. Multiple encased liquid waste transfer lines enter the box through its south wall. Liquid waste routing is made possible through the use of changeable jumper assemblies that connect pairs of waste transfer lines. Any leaks that occur are drained through the floor drain and, by gravity, through the drain line to a tank in the 244-UR Vault to the west (Hanford drawings H-2-40165; H-2-40208; H-2-44551, Sheet 70).

High-level wastes passing to and from the 241-U Tank Farm pass through this waste unit.

Fourteen stainless steel transfer lines, ranging between 3 and 6 in., enter the diversion box to connect it to the 241-UR-152, 241-UR-153, and 241-UR-154 Diversion Boxes and to the 244-UR Vault. Others run to the 241-U-151 Diversion Box near the 221-U Canyon Building and to other tank farm facilities, and to various 200 West Area operations facilities (Hanford drawings H-2-40165; H-2-40044).

Stemming from a 1953 contamination incident at the 244-UR Vault, significant surface contamination exists around and to the north of this waste unit. The facility has been sealed with plasticized foam and clean soil has been spread to stabilize contaminants. See UPR-200-W-24 and 244-UR Vault for additional comments on contamination spread.

10.17 241-UR-152 DIVERSION BOX

The 241-UR-152 Diversion Box is an inactive waste site located south of the 241-UR-151 Diversion Box and immediately east of the 241-U-101 Single-Shell Tank. It connects 241-UR-151 to the tank farm tanks, especially the 241-U-101, 241-U-102, and 241-U-103 cascade, for the transfer of waste solutions from process decontamination operations. Fifteen stainless steel lines, mostly 6 in., entered the box through its west wall.

Isolated and weather covered, it is a 37-ft by 33-ft by 12-ft high concrete box buried to a depth that places the upper surface of its lid at ground level. It is 670 ft above MSL (BHI 1994).

Its location with respect to other tank farm facilities is described on Hanford drawing H-2-44511, Sheet 70 and a complete description is on Hanford drawing H-2-40140.

10.18 241-UR-153 DIVERSION BOX

The 241-UR-153 Diversion Box is similar to the above described 241-UR-152 Diversion Box except that it primarily supports the 241-UR-104, 241-UR-105, and 241-UR-106 cascade of single-shell tanks. It operated from 1946 until 1983 and is located south of the 241-UR-151 Master Diversion Box and east of the 241-UR-104 tank. Fifteen stainless steel lines, mostly 6 in., entered the box through its west wall. It is described on Hanford drawing H-2-40565.

10.19 241-UR-154 DIVERSION BOX

The 241-UR-154 Diversion Box is essentially similar to the above described 241-UR-152 Diversion Box except that it primarily supports the 241-UR-107, 241-UR-108, and 241-UR-109 cascade of single-shell tanks. It is located south of the 241-UR-151 Master Diversion Box and east of the 241-UR-107 tank. Fifteen stainless steel lines, mostly 6 in., entered the box through its west wall. It is described on Hanford drawing H-2-40566.

10.20 241-U-153 DIVERSION BOX

The 241-U-153 Diversion is similar to the above described diversion boxes except that it is smaller, 24 ft by 20 ft by 9 ft deep. It operated from 1946 until 1981 and is located in the southeast corner of the tank farm, south of the 241-UR-151 Master Diversion Box and east of the 241-UR-110, 241-UR-111, and 241-UR-112 single-shell tanks that it primarily supports. It is described on Hanford drawing HW-72184, Sheet 2. It preceded the construction of the 241-UR-152, 241-UR-153, and 241-UR-154 Diversion Boxes by several years and served to support all 12 single-shell tanks during this early period.

10.21 244-UR VAULT

The 244-UR Vault houses four stainless steel tanks used in the transfer and interim storage of wastes being pumped to or from the 241-U Tank Farm.

It is a 90-ft by 26-ft by 45-ft deep underground concrete structure that is divided into four sections to house its four tanks. Tank TK-UR-001 is a 50,000 gal slurry accumulator tank, 20 ft in diameter. Tanks TK-UR-002 and TK-UR-003 are identical 15,000 gal blend tanks, 14 ft in diameter. Tank TK-UR-004 is a process tank 10 ft in diameter and 14 ft high (BHI 1994; Hanford drawing H-2-40044).

The vault is buried to a depth that places the upper surface of its lid about 12 in. above ground level. All above ground surfaces have been sealed with plasticized foam.

The vault interior and a large surface area around and to the north of the vault is contaminated from a violent chemical reaction that occurred in Tank TK-UR-002 in 1953. It also contains asbestos (UPR-200-W-24; BHI 1994).

Conversations with tank farm employees reveal that the above contamination included "yellowcake" and was stabilized by laying sheets of lead over the contaminated soil and covering with 12 or more in. of clean soil. Contamination continues to appear in this general area and has spread beyond the northern tank farm boundary fence. This contaminated area is roped off and routinely surveyed by Environmental Protection personnel.

Water intrusion problems are thought to exist that may have flooded the vault. It may remain flooded.

Additional contamination in this general area are described in Austin (1991) which notes:

> "A violent chemical reaction occurred at 244-UR-002 in 4/53. As a remediation the ground was excavated, sheet lead was placed on the ground and 12"-18" of gravel was backfilled to fill the hole. Sources site that under the lead is "yellowcake"."
>
> "There was an uncontrolled process liquid spread from 244-UR-151 in 7/56. TBP process liquid oozed through the coverblocks and formed two large pools. One north and west of 151-UR contaminating the control house (later removed and replaced west of that site) and the substation (still in existence and smearable). The other pool was northwest of 151-UR toward 244-UR."
>
> "Overground transfers were made at 244-UR using rubber hose. The waste was acidic, the hoses often failed and the area around the vault was contaminated many times."
>
> "241-U and 244-UR are in a low area and were often flooded, resulting in contamination spreads. Berms were built in 1979/80 to divert runoff."
>
> "The entire area has a history of water intrusion problems with resulting contamination spread."

Soil discoloration is evident in the area of the vault.

10.22 244-U RECEIVER TANK AND VAULT

The 244-U Receiver Tank is an active waste site that resides in an underground steel lined concrete vault at the south end of the 241-U Tank Farm. It is a 21-ft-diameter by 41-ft-long carbon steel tank with a capacity of 31,000 gal. It was used to "transport waste solutions from processing and decontamination operations" (BHI 1994). This is understood to mean that the tank received and held waste fluids pumped from salt wells in various 241-U Tanks.

It is buried at a depth that places the upper surface of its cover about 1 ft above ground level.

This tank and its vault are described on Hanford drawing H-2-73782 and others as listed on Hanford drawing list H-2-73780.

10.23 241-U-252 DIVERSION BOX

Located in the southwest corner of the 241-U Tank Farm, the 241-U-252 Diversion Box is a 36-ft by 9-ft by 13-ft deep reinforced concrete structure used to "transfer waste solutions from processing and decontamination operations." Operating from 1946 until 1983, it interconnected the 241-U-152 and 241-U-153 Diversion Boxes and 241-U Tank Farm (BHI 1994).

The tank and vault are described on Hanford drawing H-2-36834. A floor drain runs east from the vault to the 241-U-301 Catch Tank. The vault has been isolated and weather covered with plasticized foam.

10.24 241-U-301 CATCH TANK

The 241-U-301 Catch Tank is located at the south end of the 241-U Tank Farm, immediately east of the 241-U-252 Diversion Box to which it is connected by an underground drain line. It also served as a catch tank for the 241-U-152 Diversion Box.

Constructed in 1946, 241-U-301 is an active waste site. It is a 20 ft inside diameter by about 18 ft high concrete tank buried to a depth that places its upper surface between 10 and 11.5 ft below grade. It has a 42-in. manhole centered in its top. Four 4-in. and four 12-in. pipes extend from its top to the surface. Two 6-in. stainless steel inlet pipes enter the tank near its top. It received waste fluids that may have spilled to the floor of either diversion box. It now contains 4,900 gal of waste (BHI 1994). A site visit revealed that this facility has not been weather covered.

Hanford drawing W-72903 provides details on this tank.

10.25 241-U-A, 241-U-B, 241-U-C, AND 241-U-D VALVE PITS

The 241-U-A, 241-U-B, 241-U-C, and 241-U-D Valve Pits are essentially identical structures installed at the 241-U Tank Farm to route waste solutions to the 241-U Tanks from the 242-S Evaporator Building. The WIDS data base (BHI 1994) indicates their start date (construction date) as 1946, but this disagrees with drawings. These pits were installed much later in support of the evaporator program, probably in the late 1970's.

Although referred to by WIDS as diversions boxes, these facilities are actually valve pits that house the valves necessary for regulation of process flow between waste tanks and the evaporator building. They are 12-ft by 12-ft by 7-ft deep concrete vaults with concrete lids. Each is buried to a depth that places its upper surface about 1 ft above grade (Hanford drawing H-2-37320).

241-U-A and 241-U-B are installed between the 241-U-104 and 241-U-105 tanks. 241-U-C and 241-U-D are installed between the 241-U-110 and 241-U-111 tanks (Hanford drawings H-2-73142; SK-2-4543; H-2-37316).

10.26 2607-WUT SEPTIC TANK

The 2607-WUT Septic Tank and Drain Field is an active nonhazardous and nonradioactive waste site constructed in 1951 to receive sanitary wastewater and sewage from the 241-U Tank Farm buildings. It is capable of receiving 1.02 m^3/day of waste (BHI 1994).

Located at the north end of the tank farm, immediately north of (outside of) the security fence, it is within the boundaries of a contaminated surface area resulting from spills from the 241-UR-151 Diversion Box and the 244-UR Vault. See description of contaminations in Section 10.21.

Hanford drawing H-2-40241 describes this waste site. It consists of a 700-gal steel septic tank and a drain field made up of a 24-ft main trunk with seven 10-ft laterals arranged in a herringbone pattern. All drain field lines are perforated 8-in. VCP buried in a 34-in. bed of gravel.

10.27 ADDITIONAL DOCUMENTS WITH BEARING ON 241-U TANK FARM

Numerous additional documents which describe and characterize the 241-U Tank Farm exist but were not described in this report. These documents are available from the WHC Tank Farm Information Center.

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11.2 HANFORD SITE DRAWINGS

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H-2-02589	REPLACEMENT OF TILE FIELD FOR SEPTIC TANK 2607-W
H-2-02590	REPLACEMENT OF TILE FIELD FOR SEPTIC TANK 2607-W-5
H-2-02943	ACID LOADING SPOT PLOT PLAN
H-2-05154	VICINITY 202-S SANITARY SEWER SYSTEM SEPTIC TANK &
H-2-05962	216-S-5 REDOX WASTE WATER DISPOSAL FACILITY
H-2-10011	216-Z-1 DITCH
H-2-14035	PERMANENT PLOT PLAN

H-2-31322	CRIB DETAILS NO. 216-U-12 DISPOSAL OF UO_3 PLANT CONDENSATE
H-2-32527	U PLANT LIQUID WASTE DISPOSAL SITES, 216-U SERIES
H-2-32528	Z PLANT LIQUID WASTE DISPOSAL SITES 216-Z SERIES
H-2-34762, Sheet 1	AREA MAP
H-2-36824	U POND OVERFLOW AND DITCHES
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H-2-37315	DRAWING INDEX
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H-2-37317	CIVIL PLAN & PROFILE WASTE TRANSFER LINES
H-2-37318	CIVIL PLANS SECTIONS & DETAILS WASTE TRANSFER
H-2-37319	STRUCTURAL CONCRETE PUMP PITS 241-U-10A & 11A
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H-2-40061	241-WR ARCHITECTURAL PLOT PLAN
H-2-40075	PIPING UNDERGROUND PROCESS 241 WR AREA PLAN
H-2-40076	PIPING UNDERGROUND PROCESS 241 WR AREA SECTIONS
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H-2-40565	PIPING ARRGT. CASCADE DIV.BOX PLANS & ELEVATIONS
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H-2-41825	PIPING DETAILS BLOWER PIT
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H-2-43040	221-U BLDG UNDERGROUND PIPING LAYOUT
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H-2-43057	216-U-8 WASTE CRIB LINE
H-2-43068	CATCH TANK MODIFICATIONS AT 241-UX-154
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H-2-73785	STRUCTURAL RCVR VAULT 244-BX,TX&U SECTIONS & DET.
H-2-73786	STRUCTURAL RCVR VAULT 244-BX,TX&U SECTIONS
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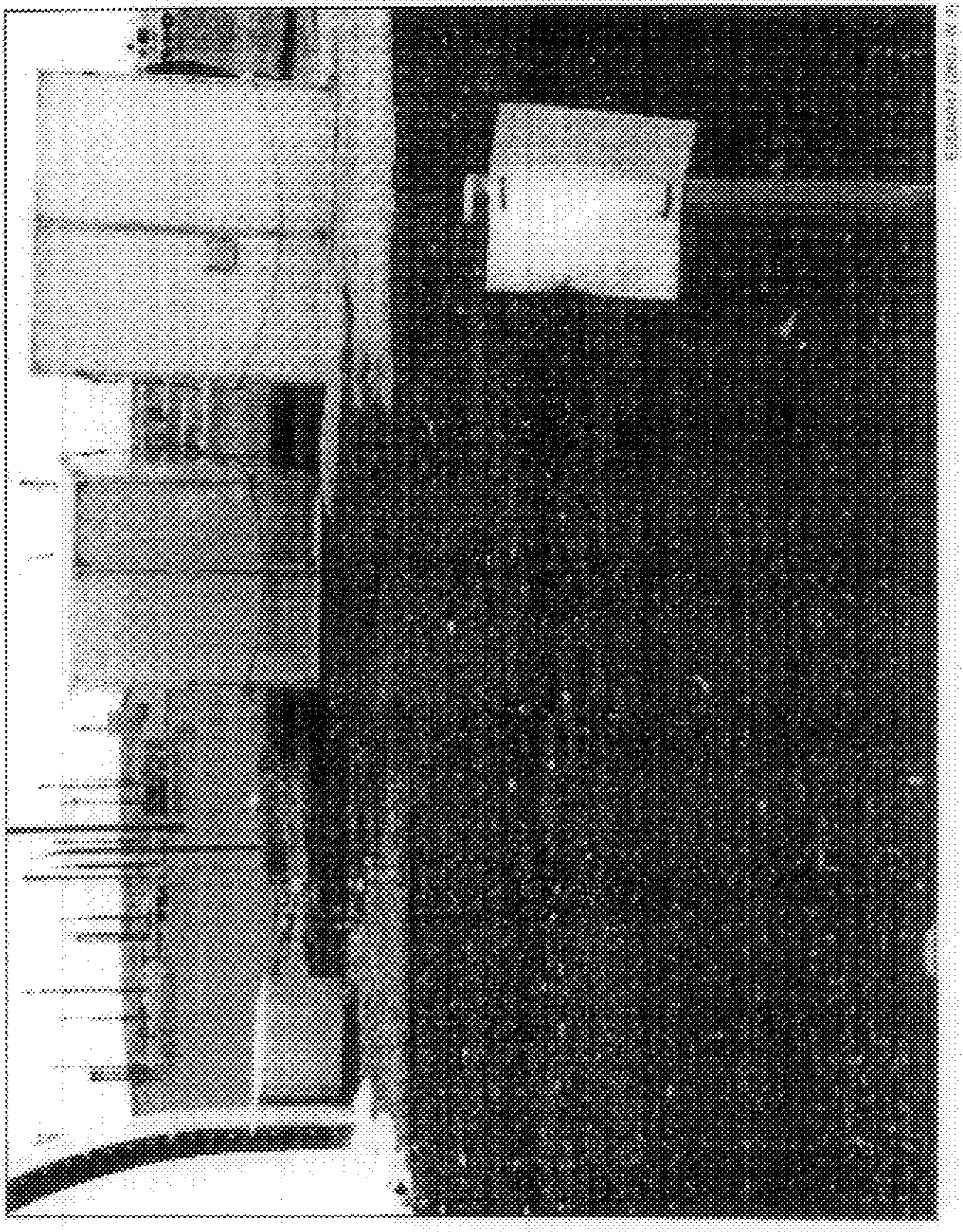
SK-2-23528, Sheet 1	Z-19 DITCH NEAR SURFACE OF DISTRIBUTION OF AMER-
SK-2-23528, Sheet 2	Z-19 DITCH NEAR SURFACE OF DISTRIBUTION OF AMER-
SK-2-23529, Sheet 1	U-14 DITCH SURFACE DISTRIBUTION OF CESIUM-137
SK-2-23529, Sheet 2	U-14 DITCH SURFACE DISTRIBUTION OF CESIUM-137
SK-2-23530, Sheet 1	U-14 DITCH SURFACE DISTRIBUTION OF ^{60}CO,^{54}MA
SK-2-23530, Sheet 2	U-14 DITCH SURFACE DISTRIBUTION OF ^{60}CO,^{54}MA
SK-2-23531, Sheet 1	U-14 DITCH NEAR SURFACE (5-15 CM) DISTRIBUTION OF
SK-2-23531, Sheet 2	U-14 DITCH NEAR SURFACE (5-15 CM) DISTRIBUTION OF
SK-2-23532, Sheet 1	U-14 DITCH NEAR SURFACE (15-30 CM) DISTRIBUTION
SK-2-23532, Sheet 2	U-14 DITCH NEAR SURFACE OF CESIUM-137
SK-2-23533, Sheet 1	U-14 DITCH CROSS SECTIONAL DISTRIBUTION OF
SK-2-23533, Sheet 2	U-14 DITCH CROSS SECTIONAL DISTRIBUTION OF
SK-2-23596, Sheet 1	TOPO BASE MAP AND LEGENDS.
SK-2-23596, Sheet 3	TOPO BASE MAP AND LEGENDS.
SK-2-23597	U-10 POND & U-11 BASIN AREA SURFACE DISTRIBUTION
SK-2-23598	U-10 POND & U-11 BASIN AREA SURFACE DISTRIBUTION
SK-2-23599	U-10 POND & U-11 BASIN AREA SURFACE DISTRIBUTION
SK-2-23600	U-10 POND & U-11 BASIN AREA SURFACE DISTRIBUTION
SK-2-23601	U-10 POND & U-11 BASIN AREA SURFACE CONCENTRATION
SK-2-23602	U-10 POND & U-11 BASIN AREA NEAR SURFACE (10-20 CM
SK-2-23603	U-10 POND AND U-11 BASIN, DISTRIBUTION OF CS 137.
SK-2-3337	ELECTRICAL
SK-2-43896	PIPING ARRANGEMENT 241-U TANK FARM VALVE PITS A&B
SK-2-4543	PIPING & INSTRUMENTATION PLAN & DETAILS 241-U-FARM
SK-2-56951	241-WR HVAC PROCESS PIPING MODIFICATIONS
W-70064	STRUCTURAL KEY PLAN
W-72903	20 FT DIAMETER CATCH TANK ARRANGEMENT AND CONCRETE
W-73636	207-T,U,B RETENTION BASIN CONCRETE PLAN AND SK-2-
W-73975	207-T,U,B RETENTION BASIN ARRANGEMENT

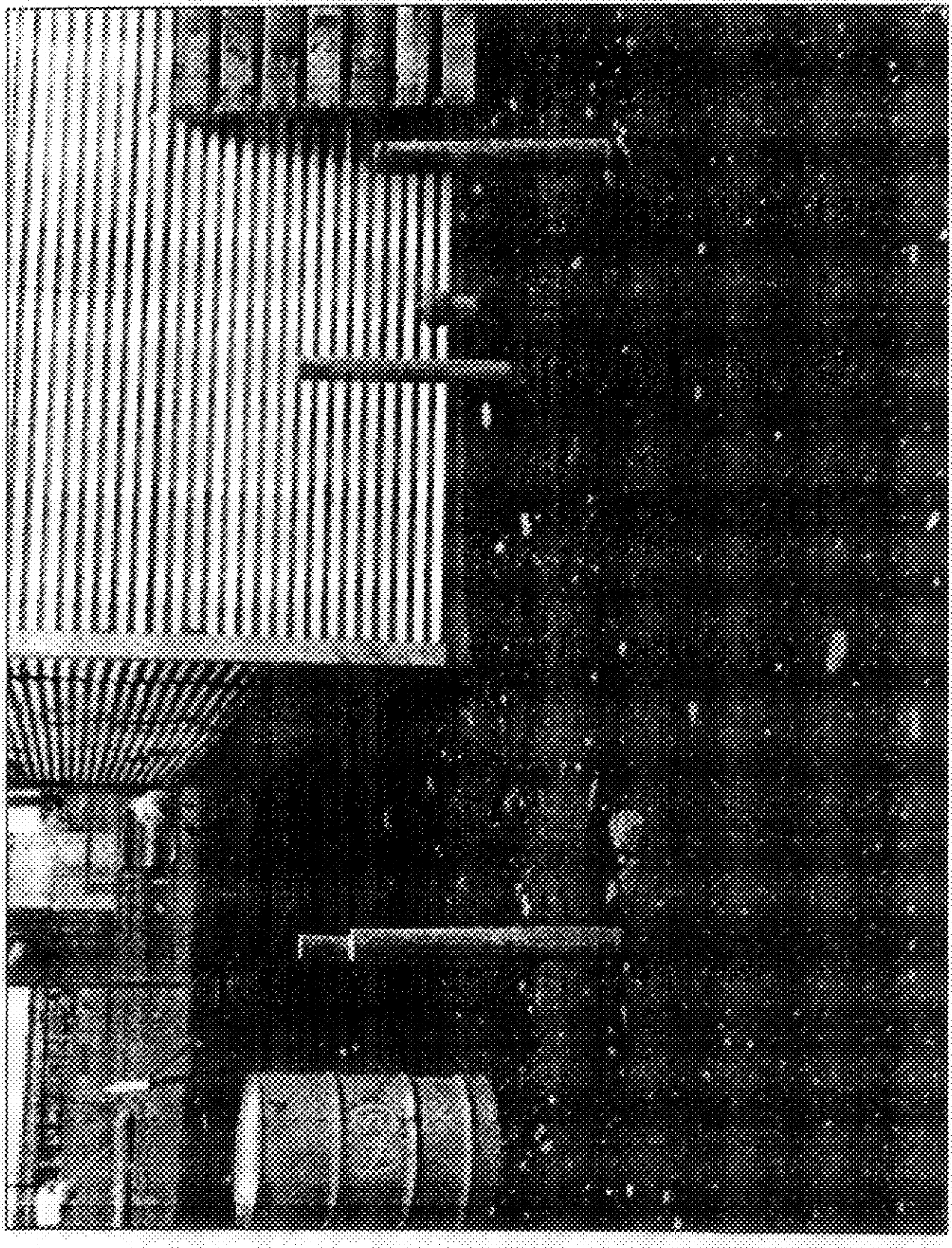
APPENDIX A

PHOTOGRAPHS

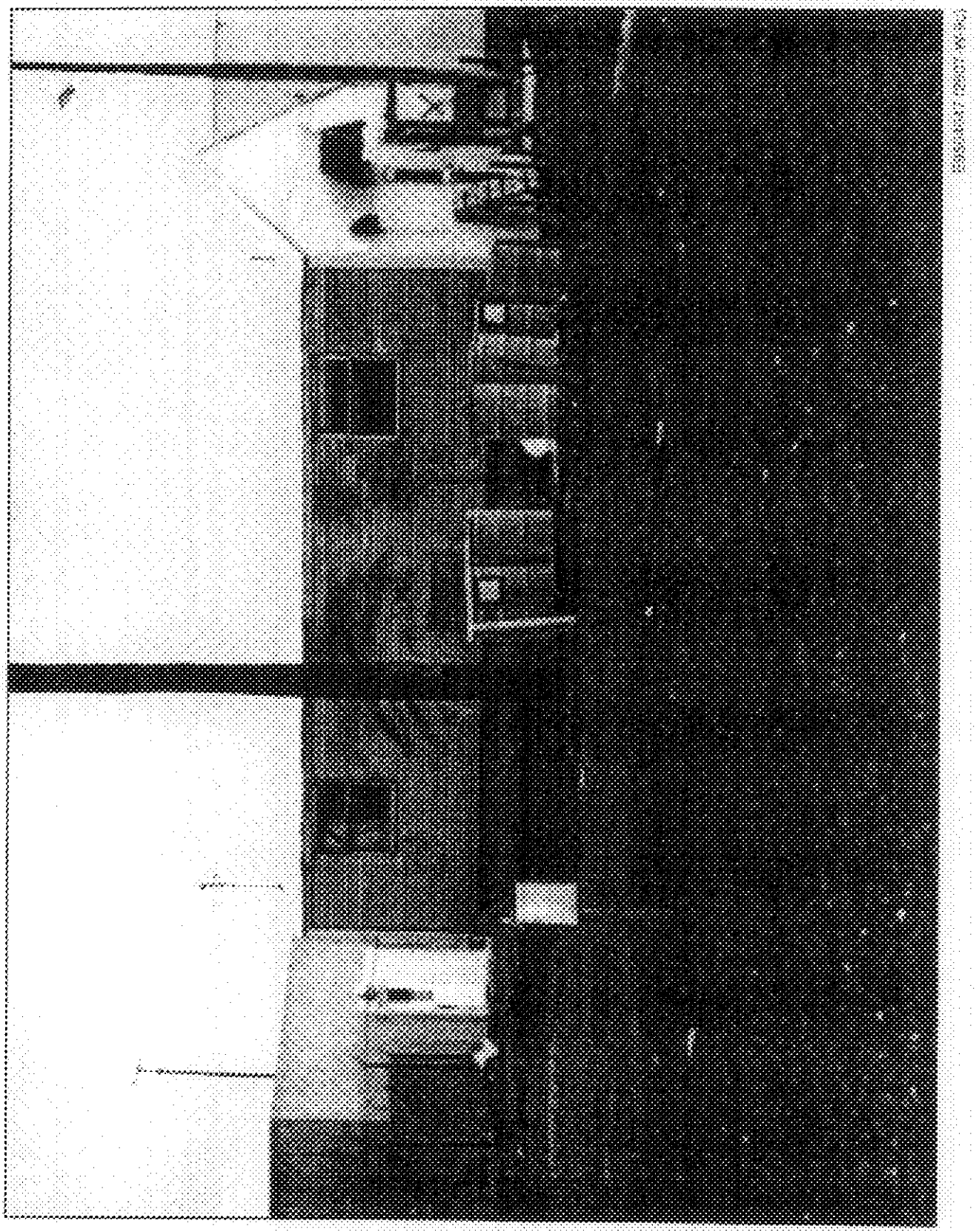
Photograph A-1. 2607-W-9 Septic Tank



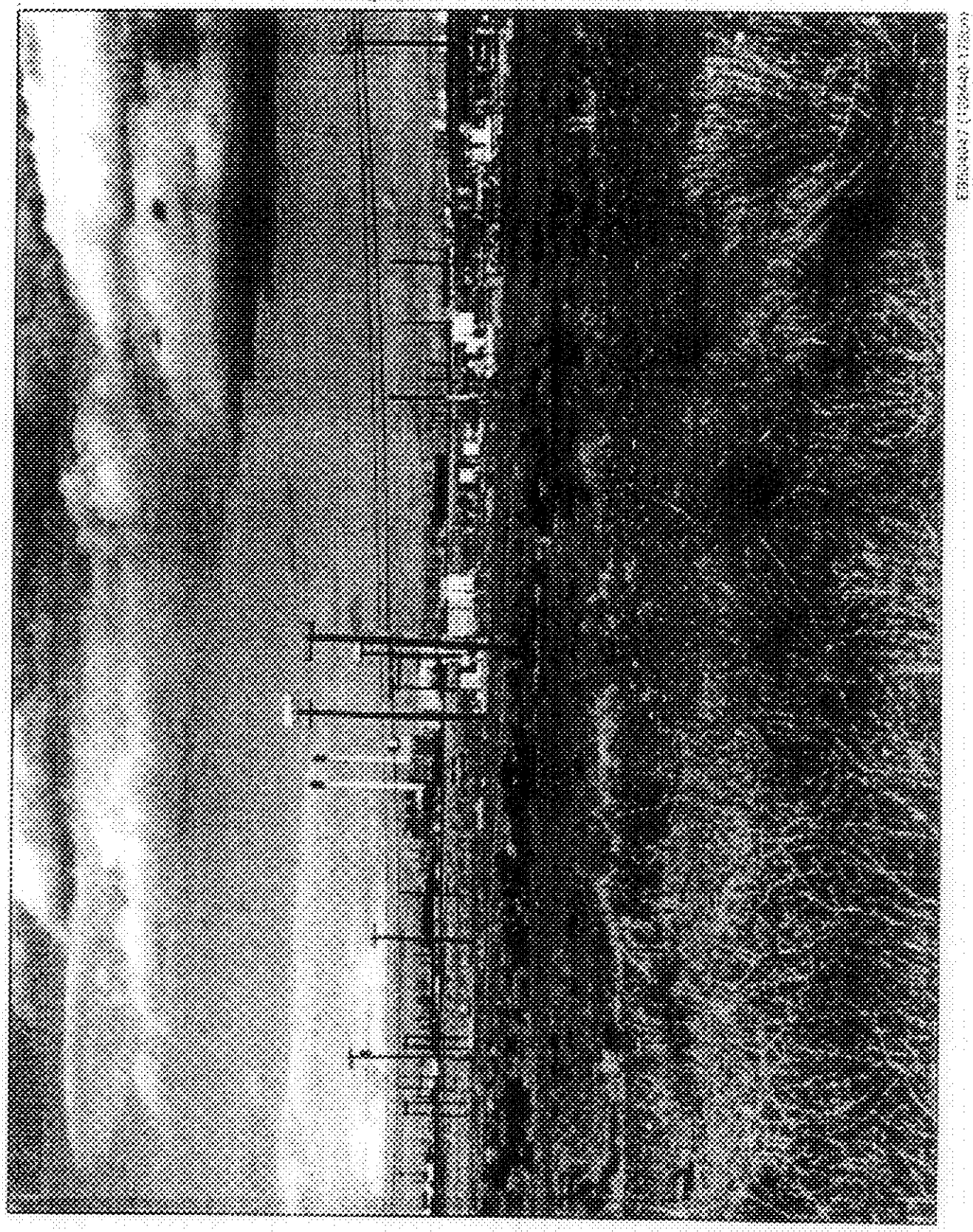
Photograph A-2. 2607-W-9 Septic Tank.



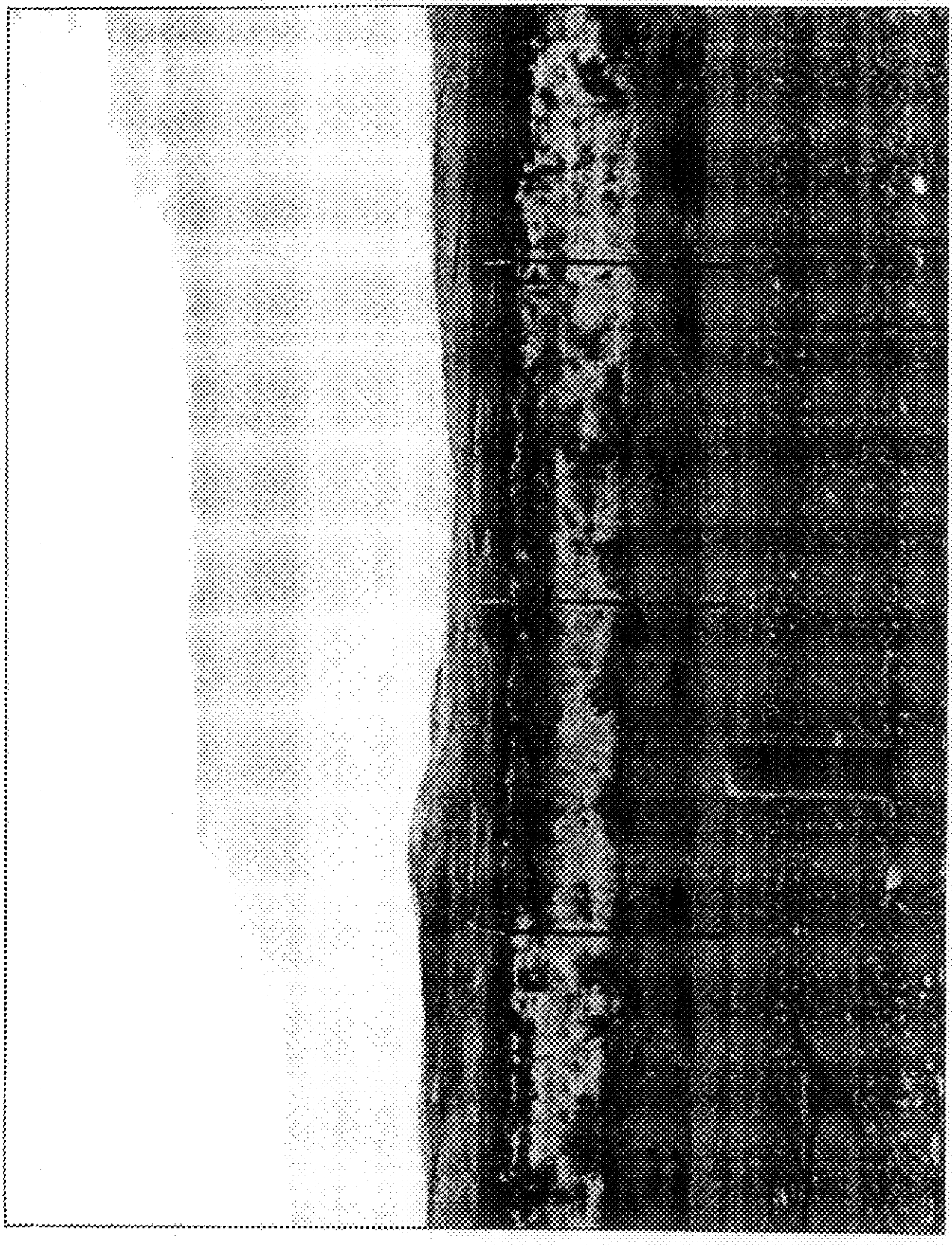
Photograph A-3. 2607-W-9 Septic Tank.



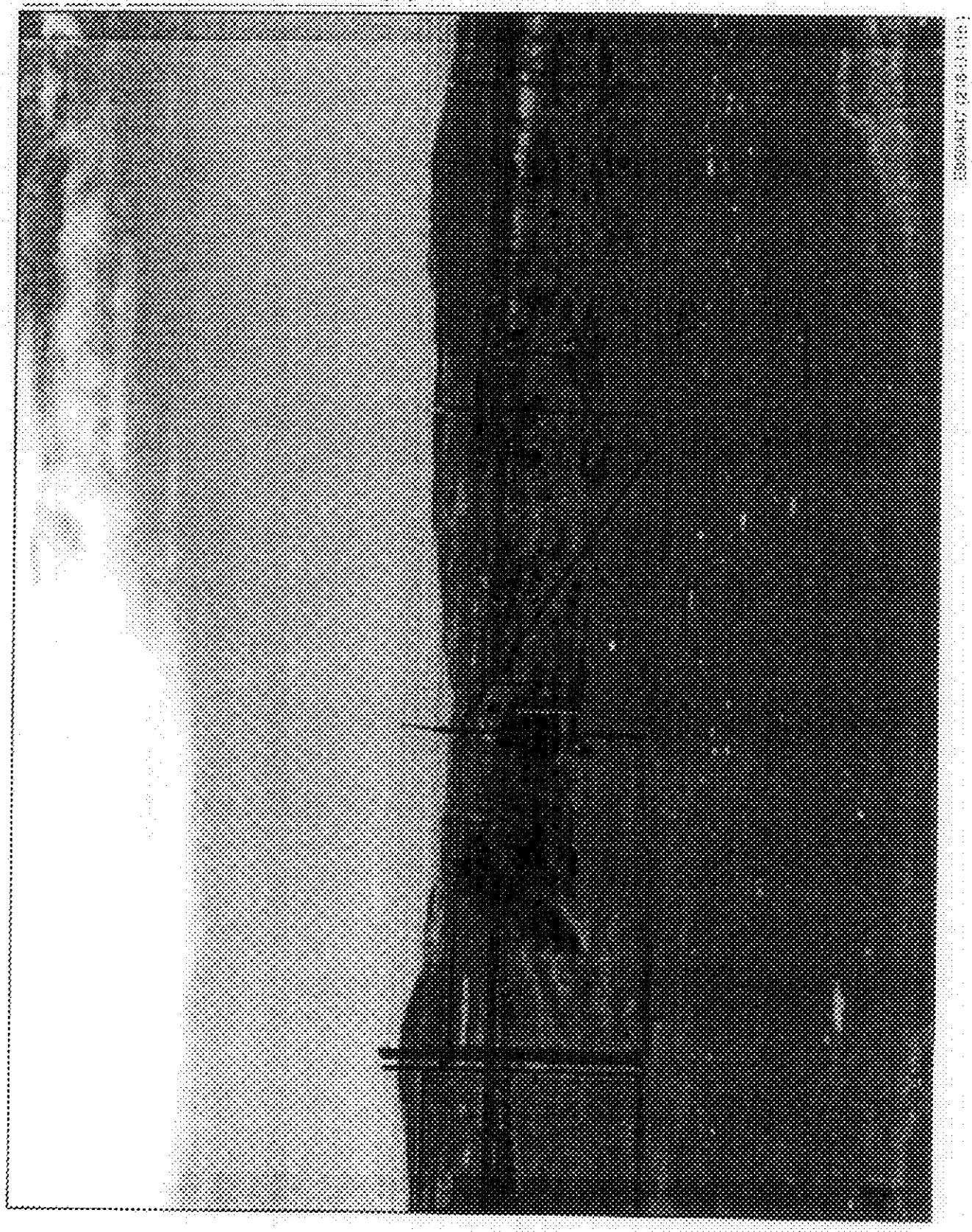
Photograph A-4. 216-U-13 Trench.



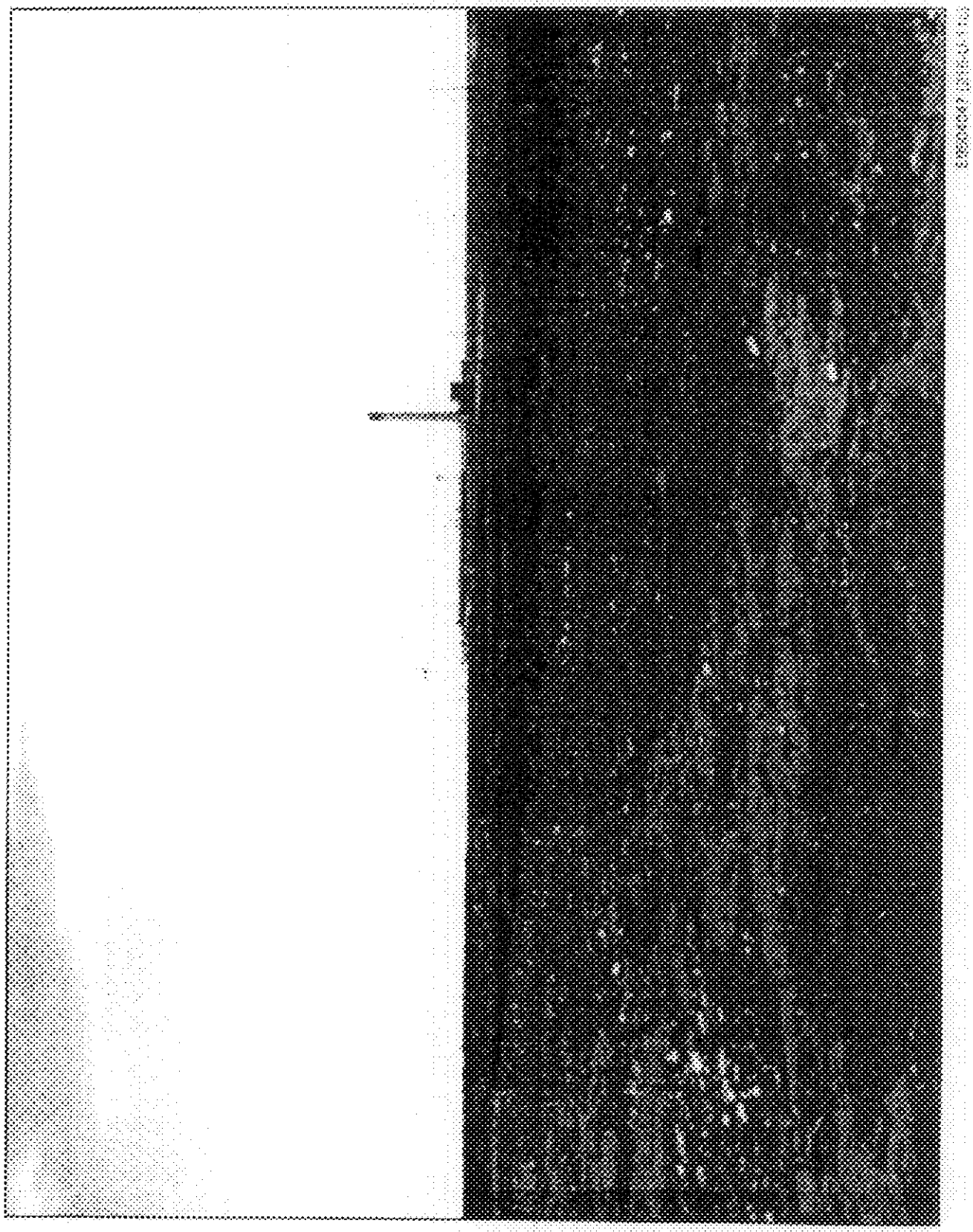
Photograph A-3. 216-U-11 Ditch



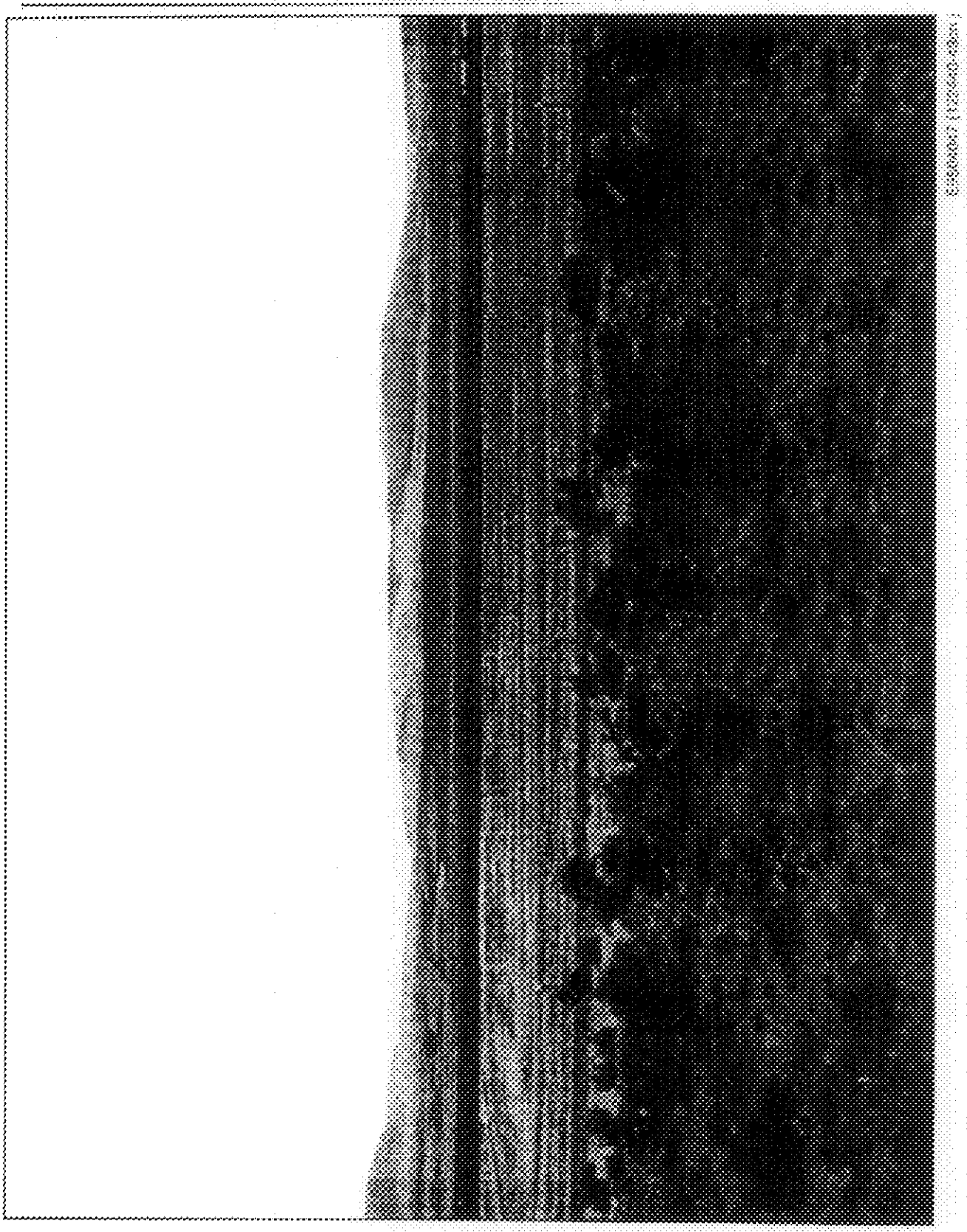
Photograph A-6 216-U-11 Ditch.



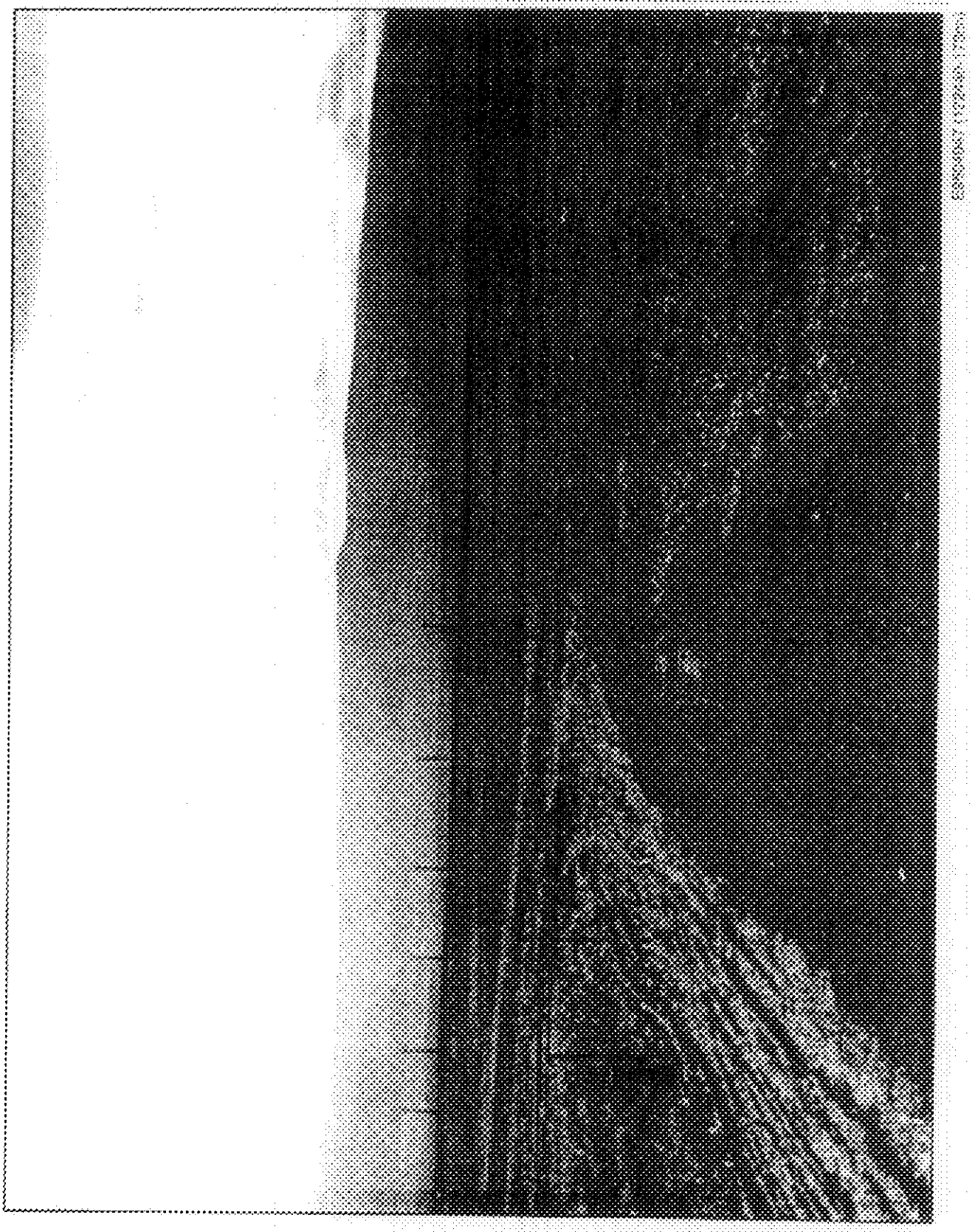
Photograph A-7. 216-U-11 Ditch.



Photograph A-8. 216-U-11 Ditch.

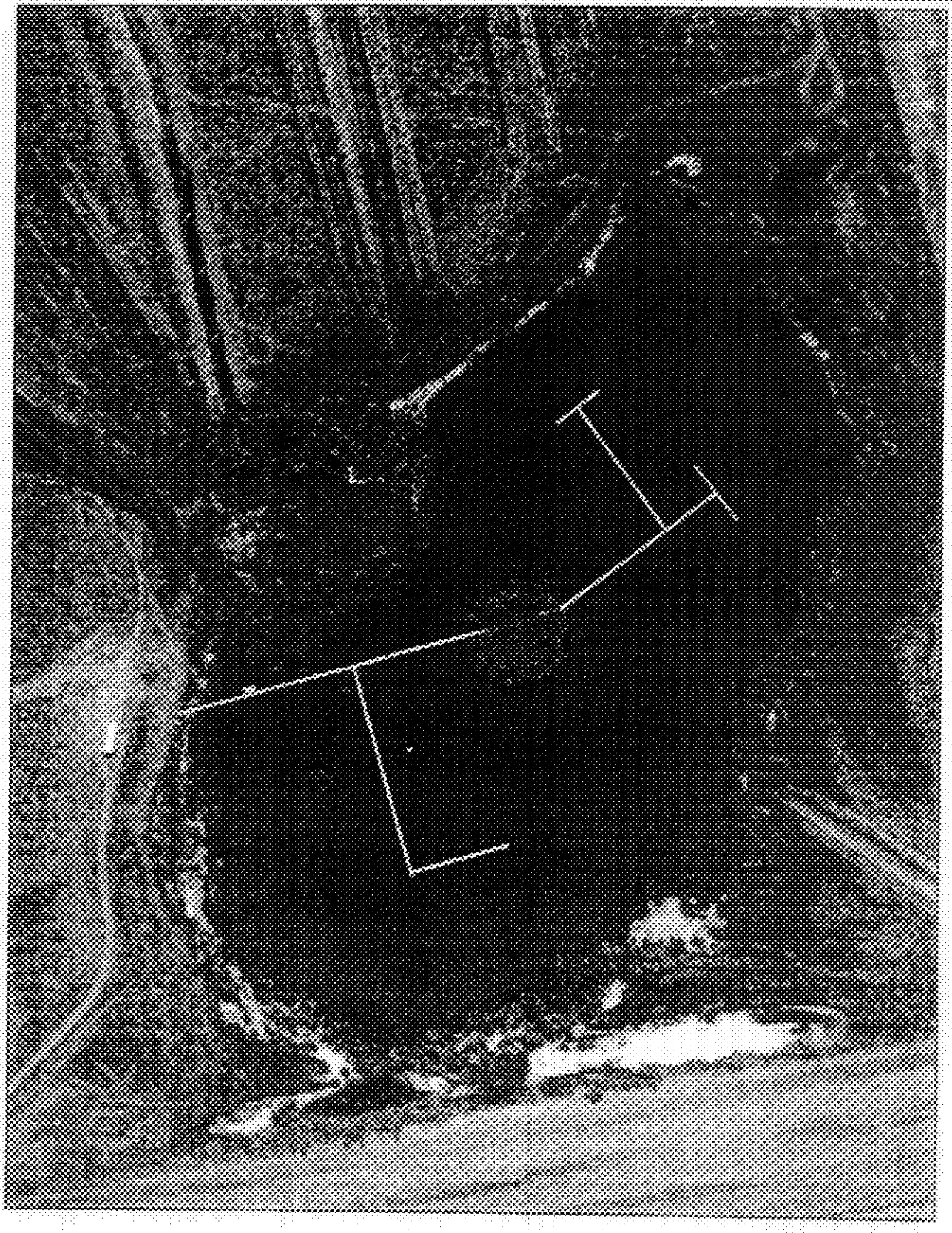


Photograph A-9 216-U-10 Pond and Ditches.

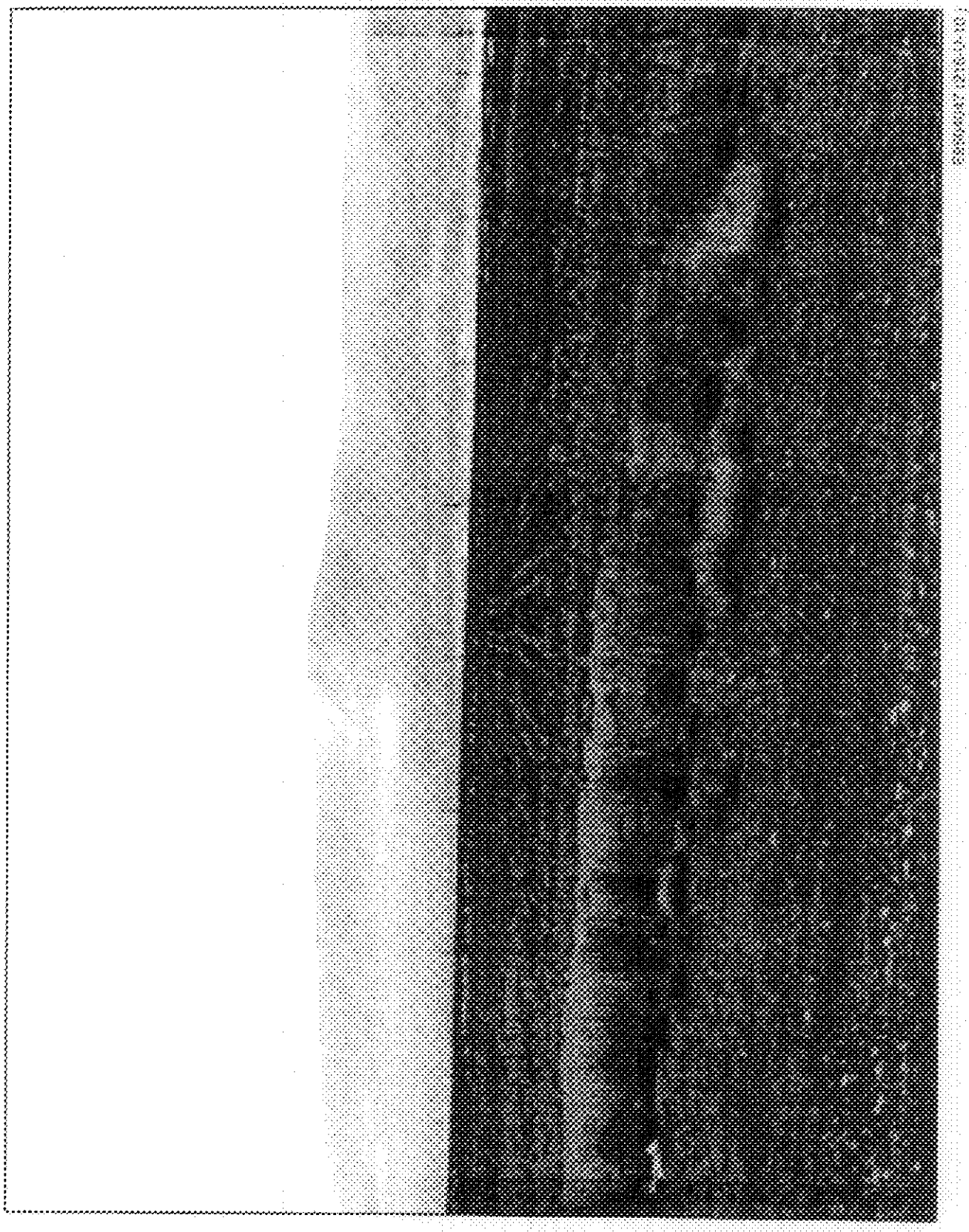


Photograph A-10. 216-U-10 Pond and Ditches

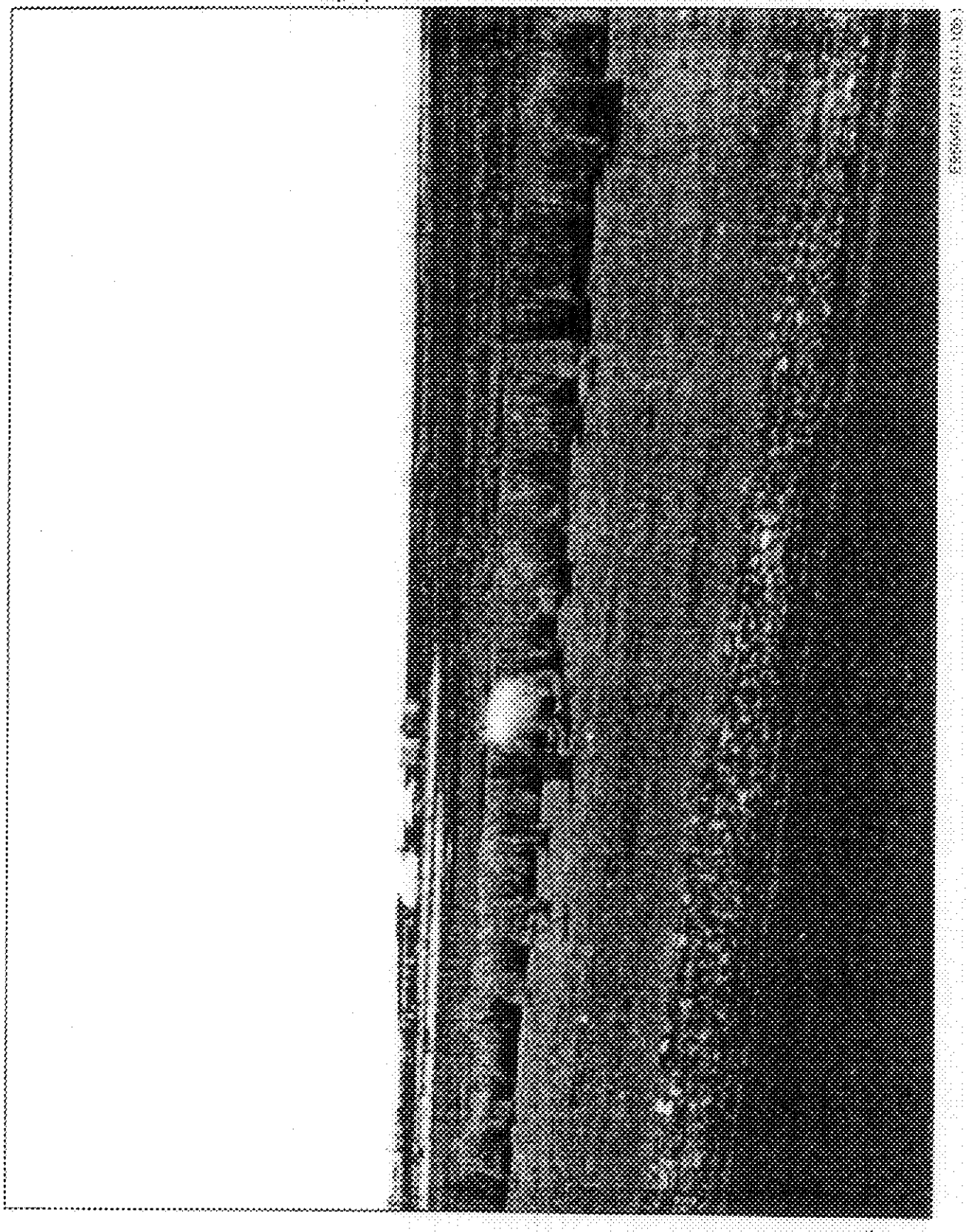
Photograph A-11. 216-U-10 Pond and Ditches



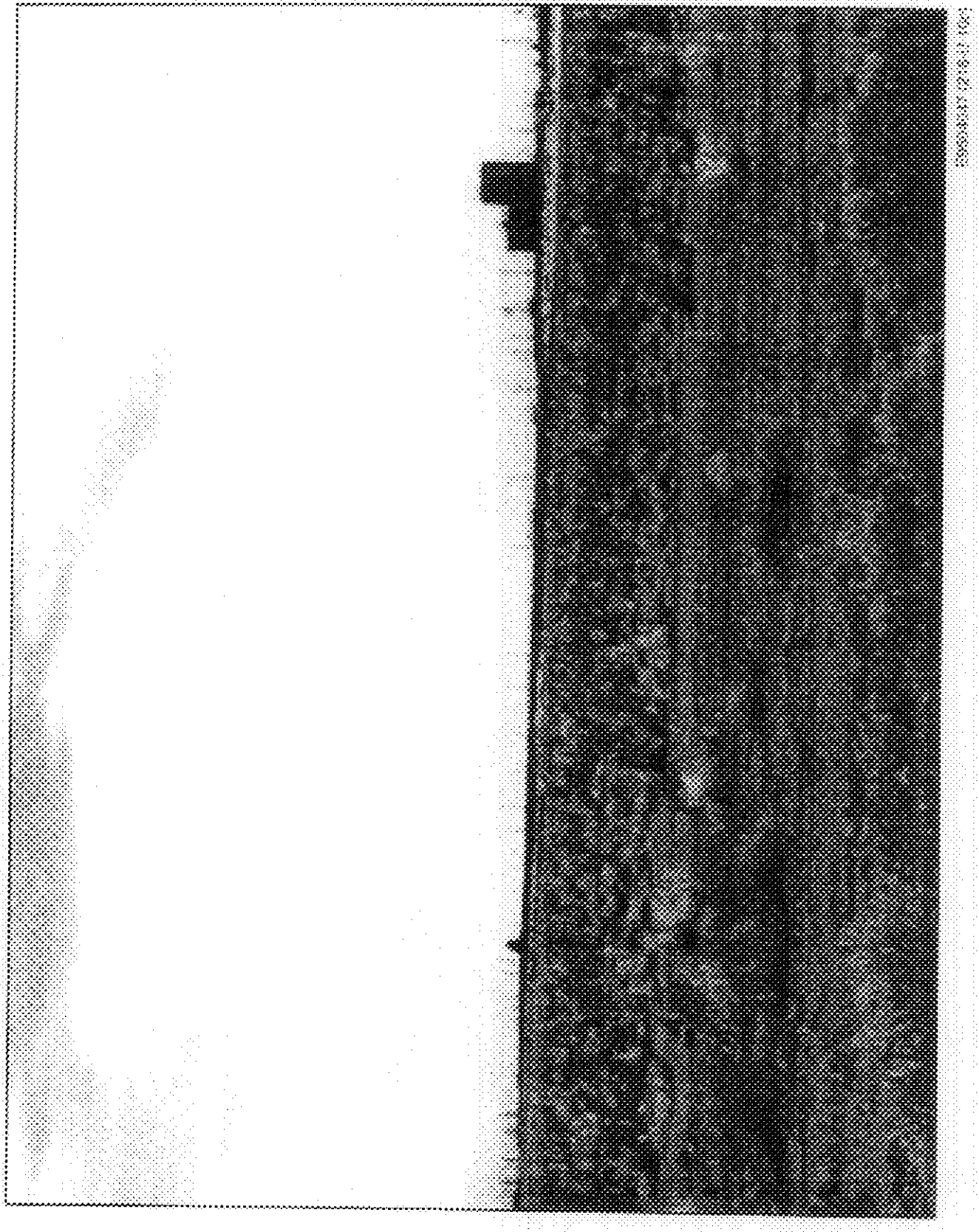
Photograph A-12. 216-U-10 Pond and Ditches.



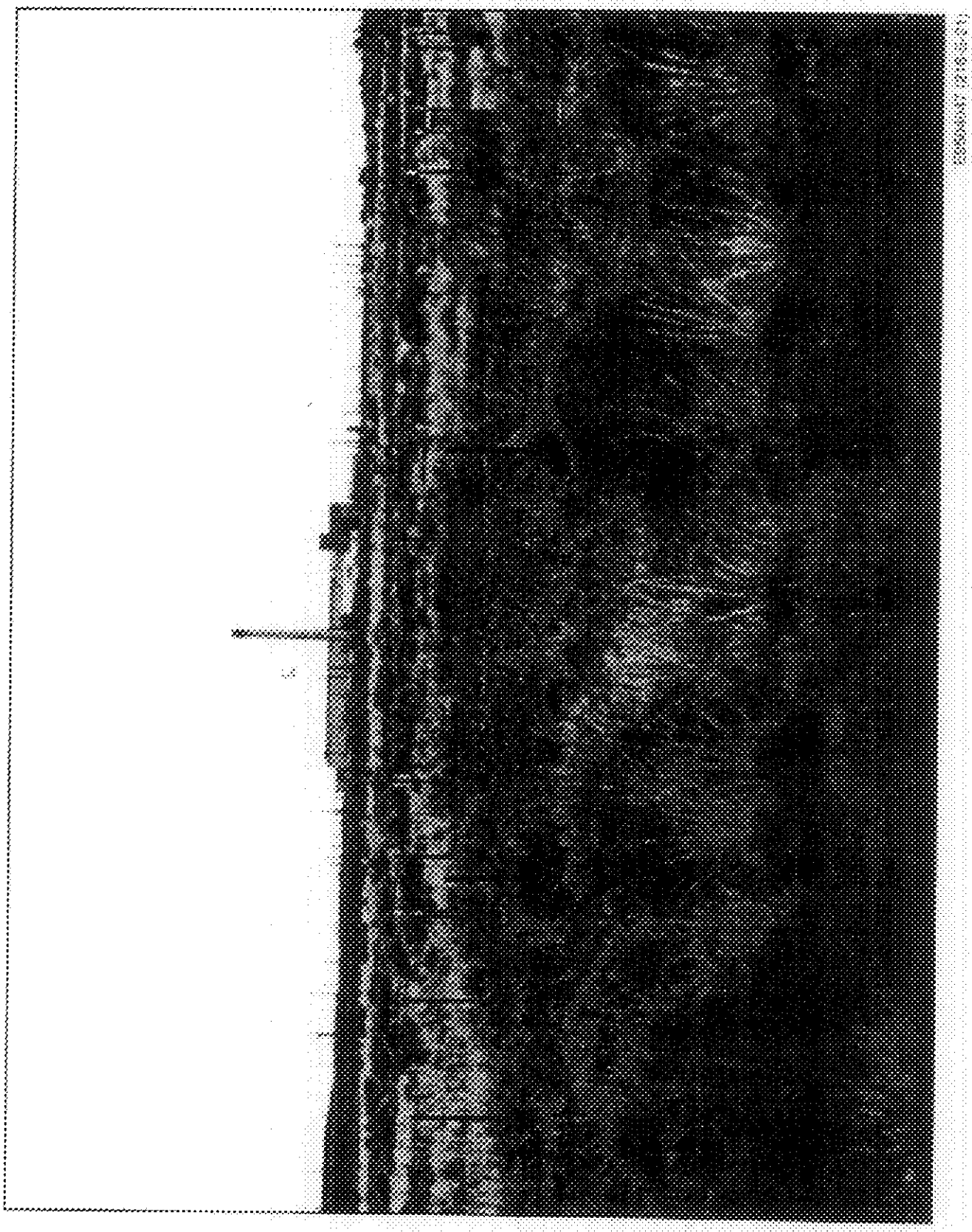
Photograph A-13. 216-U-10 Pond and Ditches



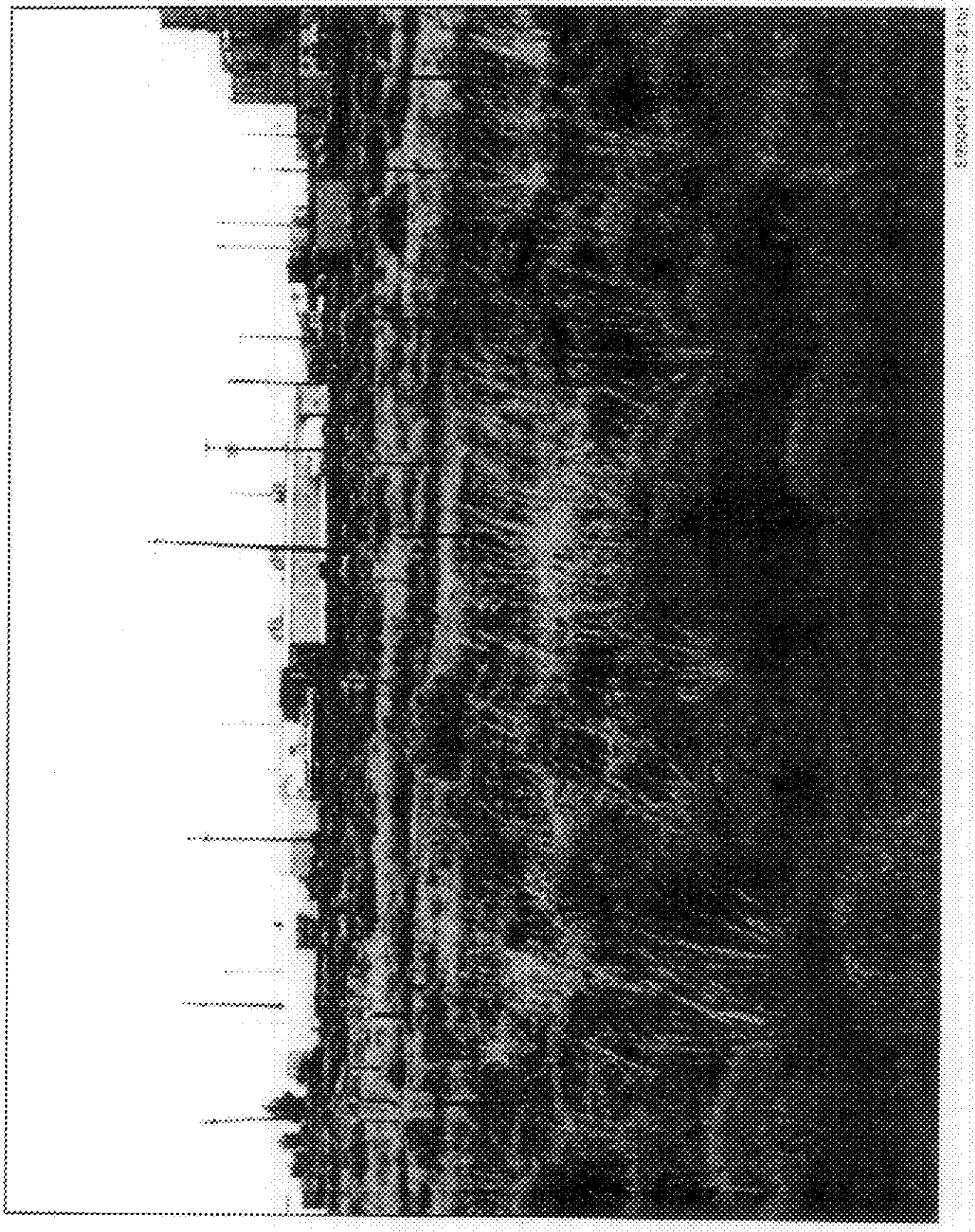
Photograph A-14. 216-U-10 Pond and Ditches.



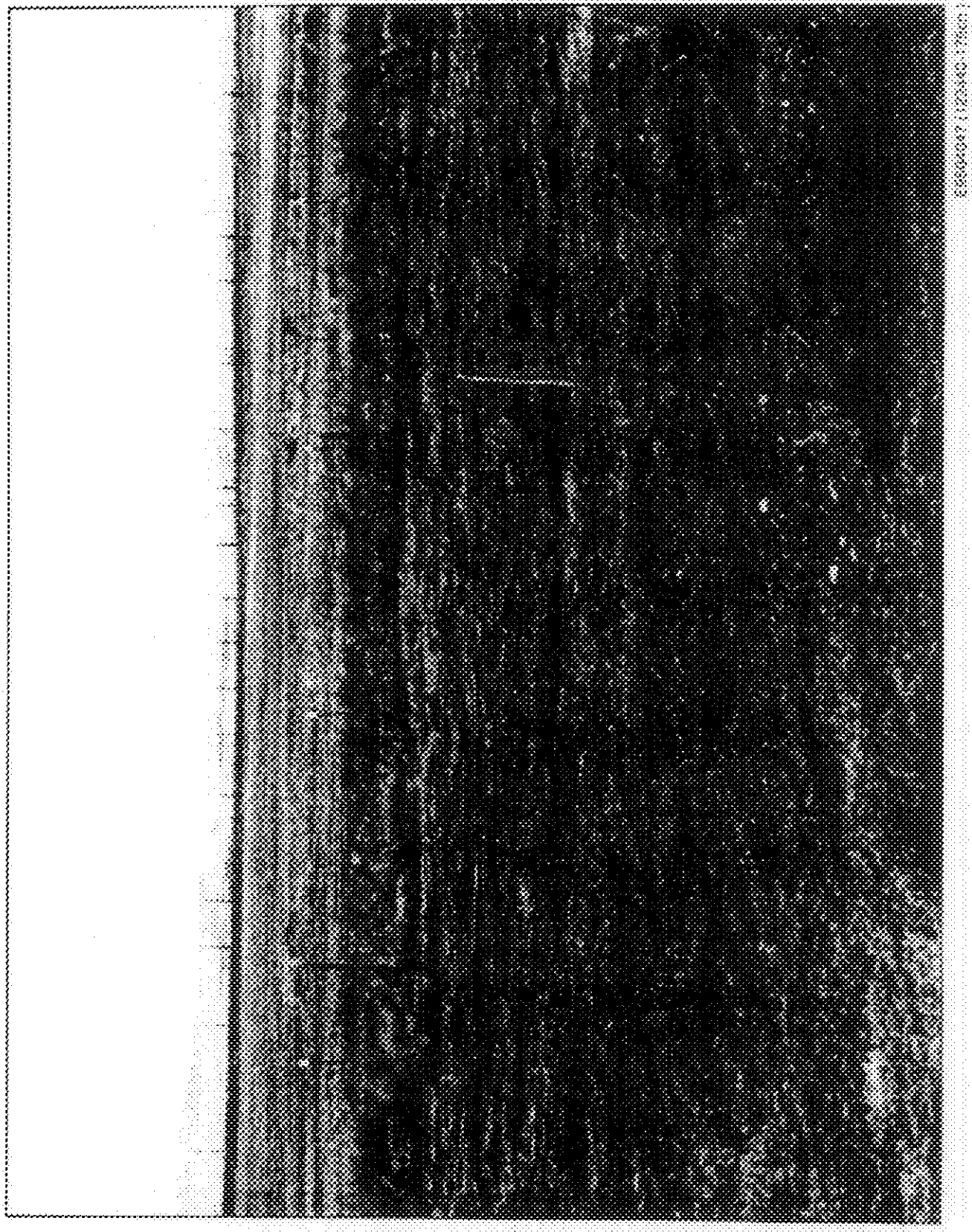
Photograph A-15. 216-S-21 Crib.



Photograph A-16. 216-S-21 Crib.



Photograph A-17. 216-S-4 French Drain.



APPENDIX B

WASTE INFORMATION DATA SYSTEM HAZARDOUS CHEMICAL AND RADIONUCLIDE INVENTORIES

Appendix B is provided under separate cover because of its size. WIDS Hazardous Chemical and Radionuclide Inventory Sheets are printouts from the Westinghouse Hanford Company Waste Information Data System. Inventories are not available for all U Aggregate Area waste units.

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